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(NASA-CR-116677) PRE-FLIGHT ACTUAL WEIGHT  
AND BALANCE REPORT. BOILERPLATE STACK NO.  
23. HIGH DYNAMIC PRESSURE ABORT TEST (North  
American Aviation, Inc.) 39 P

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SID 63-143-12W

PRE-FLIGHT ACTUAL WEIGHT AND BALANCE REPORT

BOILERPLATE STACK NO. 23

HIGH DYNAMIC PRESSURE ABORT TEST

CONTRACT NAS 9-150

(U)

ISSUED 20 NOVEMBER 1964



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ACCESSION NUMBER		DOCUMENT SECURITY CLASSIFICATION <del>CONFIDENTIAL</del>	
TITLE OF DOCUMENT			LIBRARY USE ONLY
<b>Pre-Flight Actual Weight and Balance Report</b> <b>Boilerplate Stack No. 23</b> <b>High Dynamic Pressure Abort Test</b>			
AUTHOR(S)			
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20 November 1964	NAS 9-150		
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#### ABSTRACT

The actual weight and balance report is a contractual requirement for the Boilerplate and Airframe stacks. The data contained in this report is to present the pre-flight configuration of Boilerplate Stack No. 23, derived from the actual weight and balance and thrust vector alignment determinations conducted at White Sands Missile Range.

The Launch Escape System is ballasted to obtain a desired longitudinal center of gravity for the initial abort configuration (L.E.S. and Command Module combination, prior to Escape Motor ignition). The Launch Escape configuration includes the Protective Boost Cover and Canard.

The Command Module is ballasted to a predicted weight and center of gravity and presents the configuration with the actual flight Earth Landing System installed at the time of the actual weight and balance determination.

The Service Module data presents the results from the Downey actual weight and balance determination and the changes that have occurred since its arrival at White Sands Missile Range.

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ACTUAL WEIGHT AND BALANCE REPORT  
BOILERPLATE STACK NO. 23  
HIGH DYNAMIC PRESSURE ABORT TEST

INTRODUCTION

This report presents the pre-flight mass data of Boilerplate Stack No. 23, derived from the actual weight and balance determinations of the individual module weighings conducted at White Sands Missile Range, in the Vehicle Assembly Building, between 6 October 1964 and 13 October 1964. The weighings were accomplished by the use of the HL4-154 Quotentiometer with the HL4-040 and HL4-041 Revere load cells. The load cells were calibrated by the Army Standards Lab at WSMR into the AL4-154 direct millivolt/volt reading instrument. The millivolt/volt reading is converted to true pounds mass on the individual calculation sheets as well as corrections from standard gravity to local gravity and buoyancy corrections.

Attitudes of the module weighings along with the centers of gravity derived from each weighing are listed below:

<u>ASSEMBLY</u>	<u>CENTER OF GRAVITY</u>
Launch Escape Tower (Horizontal)	X
Launch Escape System (Horizontal)	X
Command Module (Horizontal)	X
Command Module (Vertical)	Y and Z
Command Module (Single Cell)	Weight (only)
LES and Command Module - Initial (Vertical)	Y and Z
LES and Command Module - Final (Vertical)	Y and Z

Following each assembly weighing, up to the date of this report, all weight and/or center of gravity changes were monitored, plus future known changes, and are employed in the determination of the mass properties for the subject boilerplate at launch.

These corrections are summarized on page 25 for the Launch Escape Tower, page 28 for the Launch Escape System, Page 34 for the Command Module and page 41 for the Launch Escape System and Command Module combination.

Due to the Service Module weight and balance fixtures not being provisioned for use at WSMR, the Service Module weight and center of gravity was monitored for changes since the Downey weighing (refer to SID 63-143-12, issued 5 October 1964). These changes are noted on page 36.

A single cell pull-up weight of the Command Module was performed for a weight verification to assure that no side loads were encountered during the horizontal and vertical weighings of the Command Module. This weight is indicated on page 33.

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A summary of the weight, center of gravity and inertia for Boilerplate Stack No. 23 from total launch payload to Command Module at touchdown is presented on pages 3 and 4. The mass properties for the Launch Escape Vehicle (LES and C/M) have been computed for 0.5 second intervals of main motor burning to burnout and also including the pitch motor burning within the cycle. The mass properties summary reflects the rotated LES as derived from the thrust vector alignment determination.

The Launch Escape System is ballasted to meet a required longitudinal center of gravity ( $X_a = 1156.0 \pm 0.5$  inches) for the combined LES and Command Module at launch. The mass properties for the Launch Escape System and the C/M forward apex cover with the jettison motor burning at 0.5 second intervals to burnout (1.4 seconds) are also included on page 4.

All inertia data presented in the summary are calculated values. All weighings entailed three consecutive determinations, results of which were averaged to derive the reported mass properties, as shown in the summary.

Curves presenting weight versus center of gravity and inertia are also included. These curves present the LEV at 0.5 second burning intervals, the deployment of the drogue chutes, drogue disconnect, deployment of pilot chutes, deployment of main chutes, Command Module at touchdown and the LES and forward apex cover for jettison burning cycle.

The weight breakdown summaries present the functional groupings of structure and system weights of the various components. A manufacturing variation is shown to indicate the difference of the actual weight from the calculated weight.

The dimensional diagram, page 45, shows the relationship of the Apollo Spacecraft Xa stations, which have an origin 998.7 inches below the tangency of the Command Module structure mold line.

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~~CONFIDENTIAL~~WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARYHIGH DYNAMIC PRESSURE ABORT TESTBOILERPLATE STACK NO. 23PRE-FLIGHT DATA

ITEM	WEIGHT	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT.2)		
		Xa	Ya	Za	ROLL (X)	PITCH (Y)	YAW (Z)
LAUNCH ESCAPE SYSTEM (INITIAL)	8145	1293.4	-0.4	-0.4	573	20598	20599
COMMAND MODULE	9975	1043.5	0.5	6.6	5621	4851	4823
SERVICE MODULE	9523	932.6	-0.7	-7.5	10923	11204	10216
<b>TOTAL LAUNCH PAYLOAD</b>	<b>27643</b>	<b>1078.9</b>	<b>-0.2</b>	<b>-0.3</b>	<b>17328</b>	<b>16443</b>	<b>163220</b>
LESS: SERVICE MODULE	-9523	932.6	-0.7	-7.5	10923	11204	10216
<b>TOTAL LEV* (ABORT INITIAL)</b>	<b>18120</b>	<b>1155.8</b>	<b>0.1</b>	<b>3.5</b>	<b>6242</b>	<b>85964</b>	<b>85891</b>
LEV (t = +0.5)	17737	1152.8	0.1	3.6	6236	81064	83993
LEV (t = +1.0)	17335	1149.4	0.1	3.7	6228	82090	82020
LEV (t = +1.5)	16932	1146.0	0.1	3.8	6220	80023	79955
LEV (t = +2.0)	16533	1142.4	0.1	3.9	6210	77885	77818
LEV (t = +2.5)	16155	1138.8	0.1	3.9	6200	75768	75702
LEV (t = +3.0)	15812	1135.4	0.1	4.0	6189	73766	73701
LEV (t = +3.5)	15511	1132.2	0.2	4.1	6179	71940	71877
LEV (t = +4.0)	15308	1130.1	0.2	4.2	6172	70671	70608
LEV (t = +4.5)	15182	1128.7	0.2	4.2	6167	69867	69805
LEV (t = +5.0)	15091	1127.7	0.2	4.2	6164	69278	69217
LEV (t = +5.5)	15035	1127.1	0.2	4.3	6162	68913	68851
LEV (t = +6.0)	14993	1126.6	0.2	4.3	6160	68637	68576
LEV (t = +6.5)	14965	1126.3	0.2	4.3	6159	68452	68391
LEV (t = +7.0)	14937	1126.0	0.2	4.3	6158	68267	68206
LEV (t = +7.5)	14920	1125.8	0.2	4.3	6157	68154	68093
LEV (t = +8.0)	14903	1125.6	0.2	4.3	6157	68041	67980

\*Centers of gravity are in the NASA reference system except that the longitudinal (Xa) has an origin 998.7 inches below the tangency of the Command Module structure mold line.

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WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARYHIGH DYNAMIC PRESSURE ABORT TESTBOILERPLATE STACK NO. 23PRE-FLIGHT DATA

ITEM	WEIGHT	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT. <sup>2</sup> )		
		X <sub>a</sub>	Y <sub>a</sub>	Z <sub>a</sub>	ROLL (X)	PITCH (Y)	YAW (Z)
I/FV (LES BURNOUT)	14,903	1125.6	0.2	4.3	6157	68041	67980
LESS: LES (BURNOUT) PLUS FWD. H/S	-5369	1276.0	-0.3	-0.1	589	22567	22560
C/M PRIOR TO DROGUE DEPLOYMENT	9534	1040.8	0.5	6.8	5532	4469	4449
LESS: DROGUE CHUTES	-51	1090.8	0.0	-21.8	1	-	1
C/M PRIOR TO DROGUE DISCONNECT	9483	1040.6	0.5	7.0	5521	4432	4420
LESS: DROGUE DISCONNECT	-6	1104.6	0.0	-17.8	-	-	-
C/M PRIOR TO PILOT CHUTE DEPLOYMENT	9477	1040.5	0.5	7.0	5520	4426	4415
LESS: PILOT CHUTES	-21	1087.2	3.7	3.2	3	1	2
C/M PRIOR TO MAIN CHUTE DEPLOYMENT	9456	1040.4	0.5	7.0	5517	4415	4403
LESS: MAIN CHUTES	-408	1092.1	-0.6	8.0	51	19	41
C/M AT TOUCHDOWN	9048	1038.1	0.6	6.9	5466	4150	4117
L.E.S. AND FWD. H/S (Jettison t = +0.0)	5369	1276.0	-0.3	-0.1	589	22567	22560
L.E.S. AND FWD. H/S (Jettison t = +0.5)	5292	1274.0	-0.3	-0.1	587	22268	22261
L.E.S. AND FWD. H/S (Jettison t = ±1.0)	5202	1271.7	-0.3	-0.1	585	21907	21900
L.E.S. AND FWD. H/S (Jettison Burnout)	5164	1270.7	-0.3	-0.1	584	21753	21747

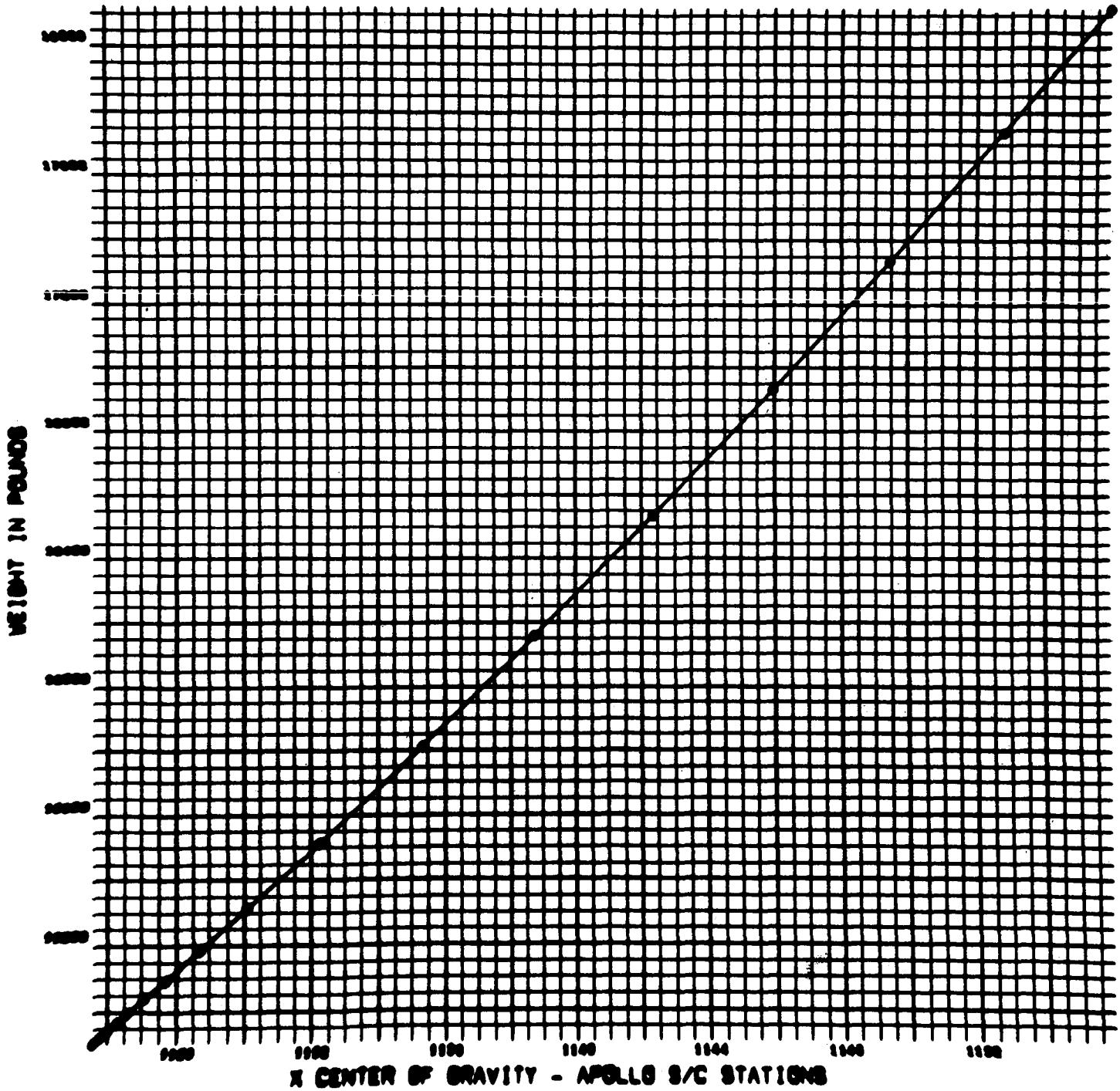
\*Centers of gravity are in the NASA reference system except that the longitudinal (X<sub>a</sub>) has an origin 998.7 inches below the tangency of the Command Module structure mold line.

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EP 23 TVA CONDITION

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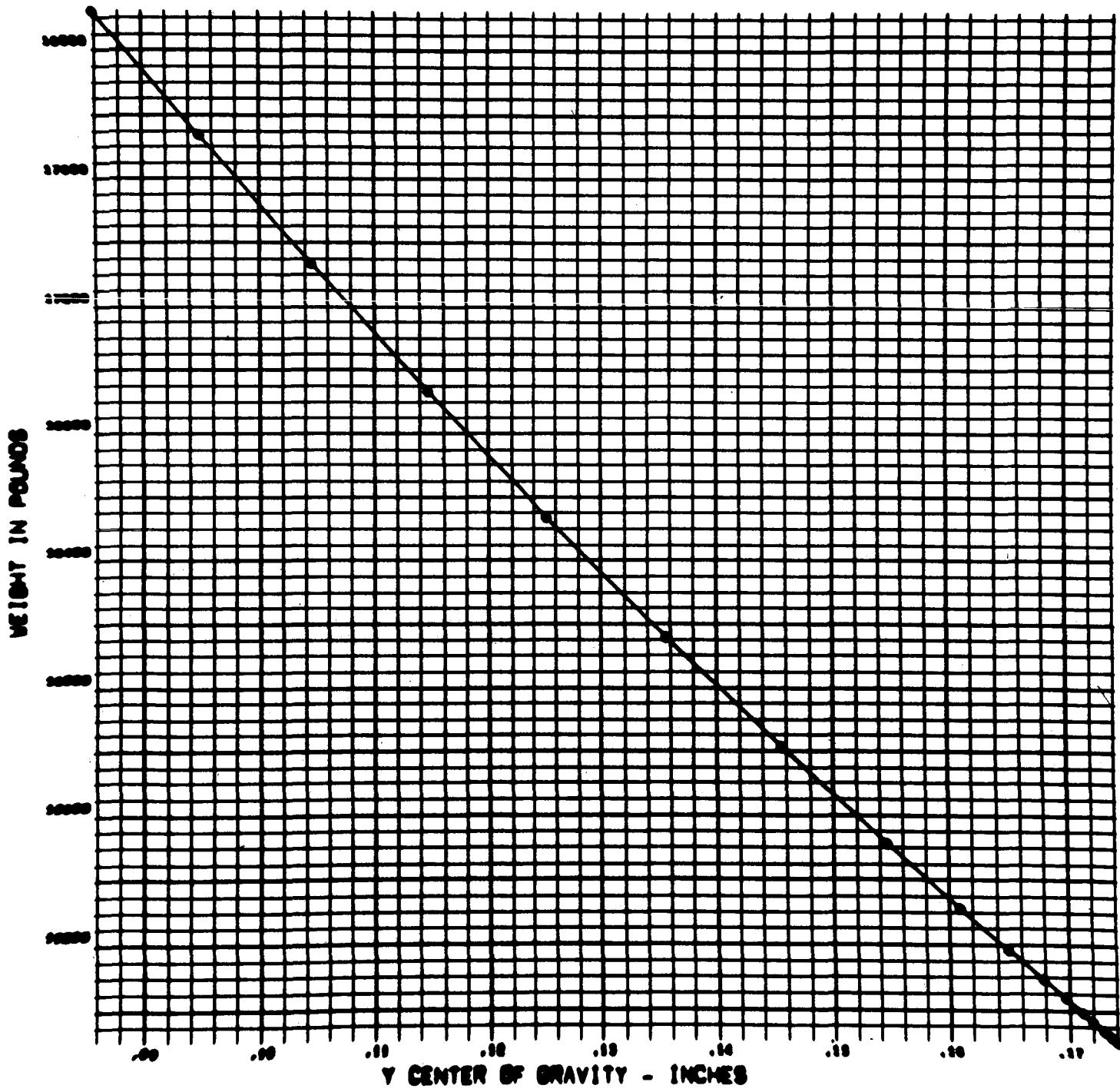
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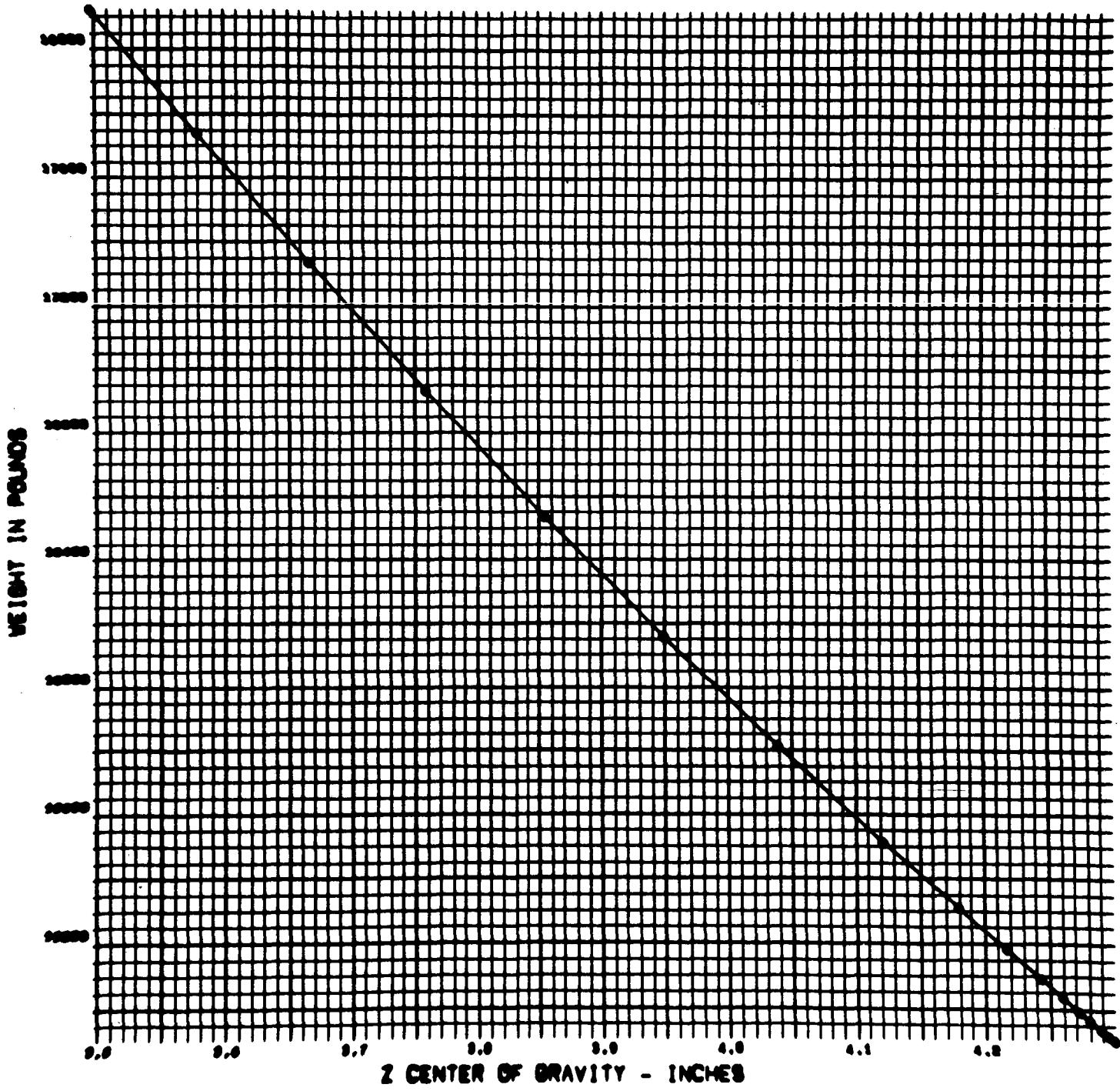
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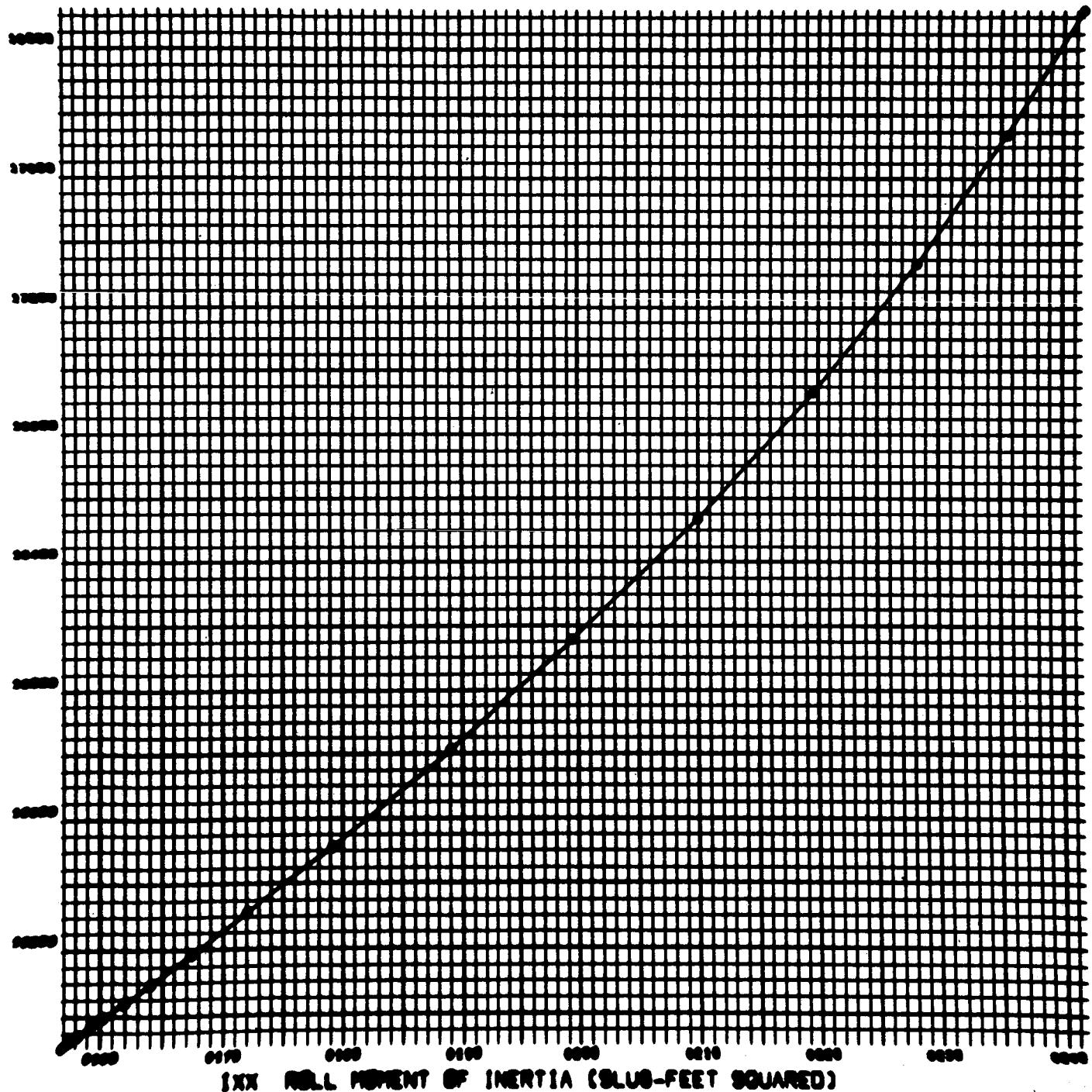
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WEIGHT IN POUNDS



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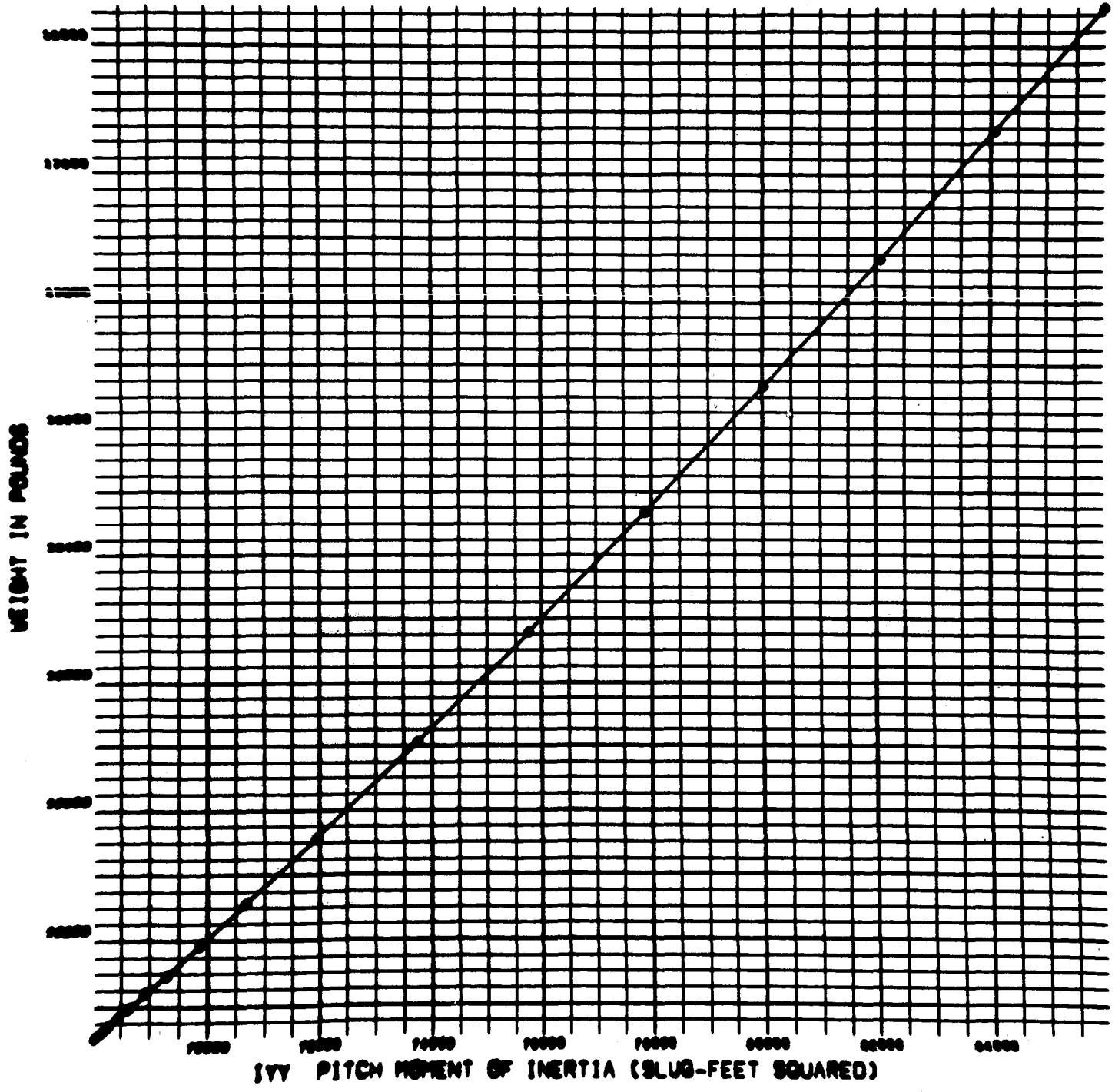
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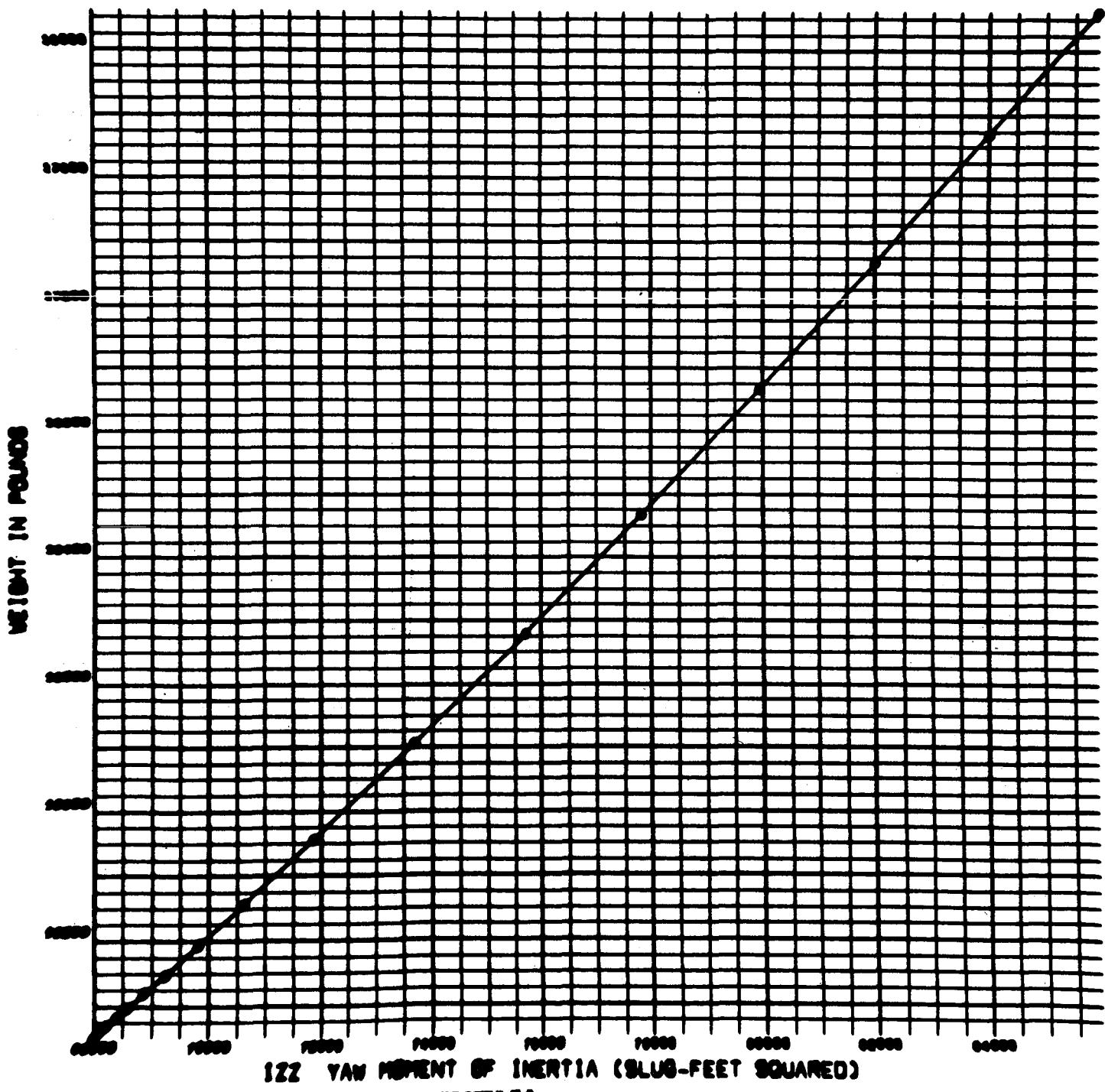
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BP 23 TVA CONDITION

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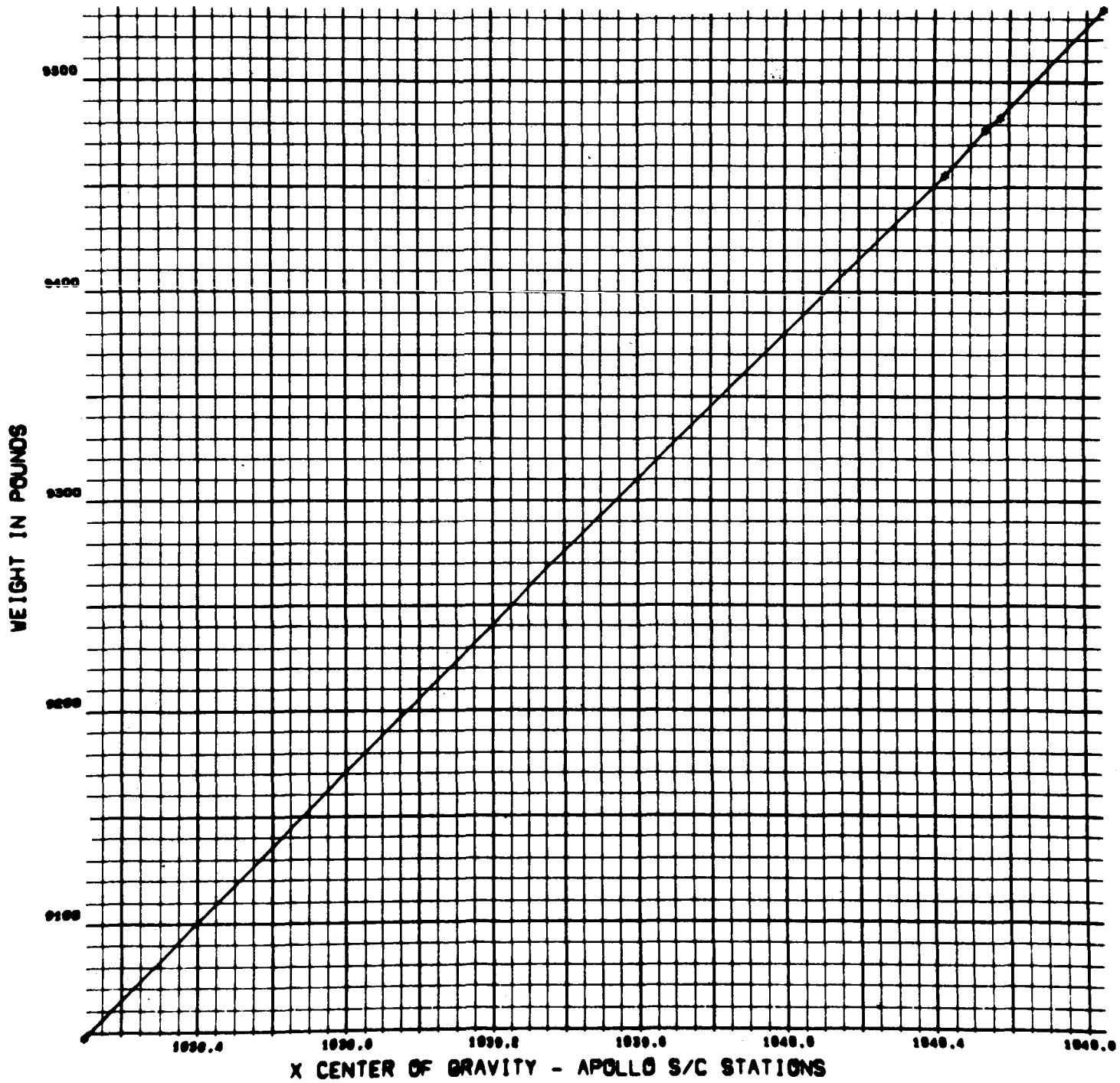
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BP 23 COMMAND MODULE DESCENT PHASE

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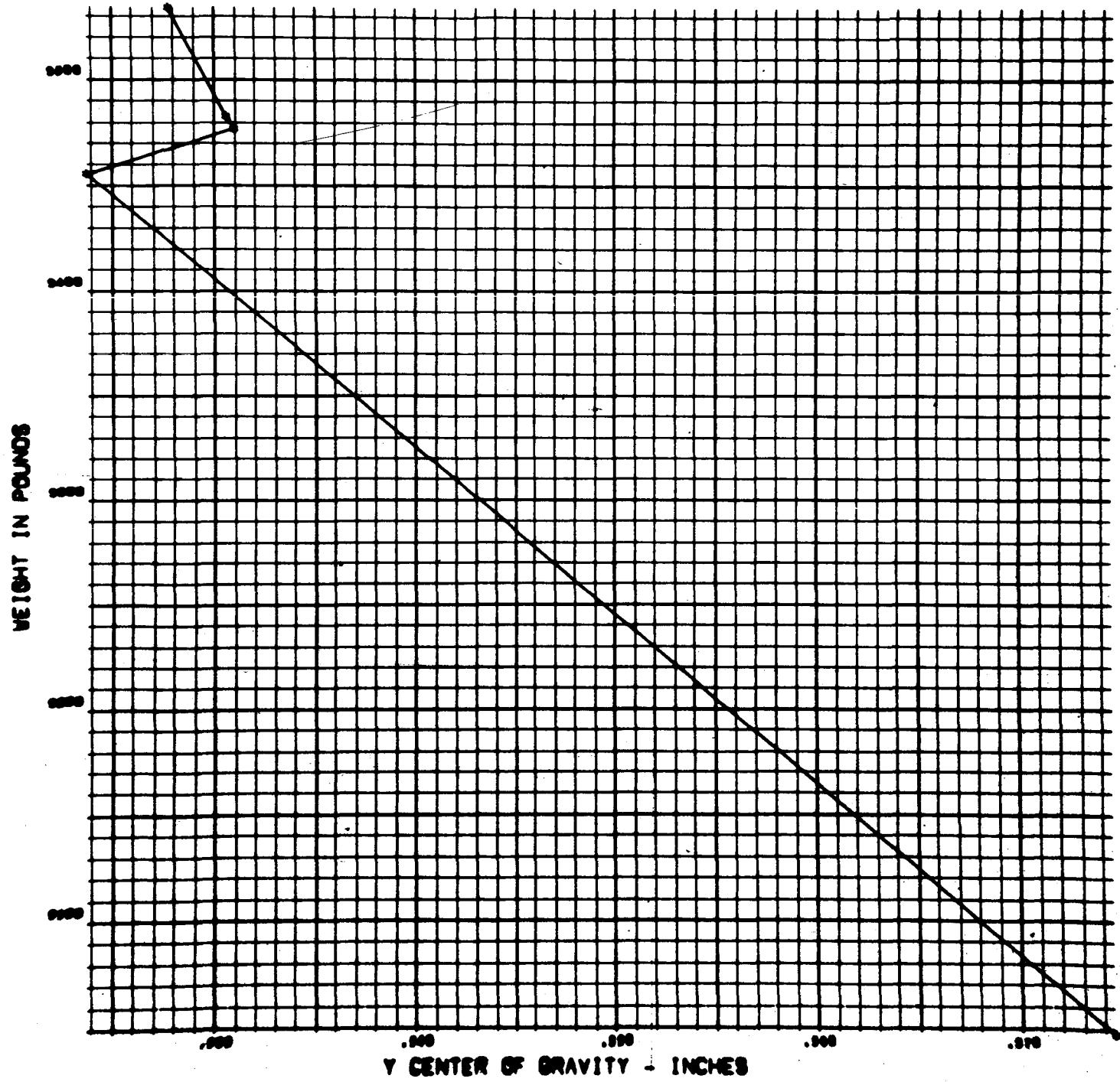
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BP 23 COMMAND MODULE DESCENT PHASE

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002 000



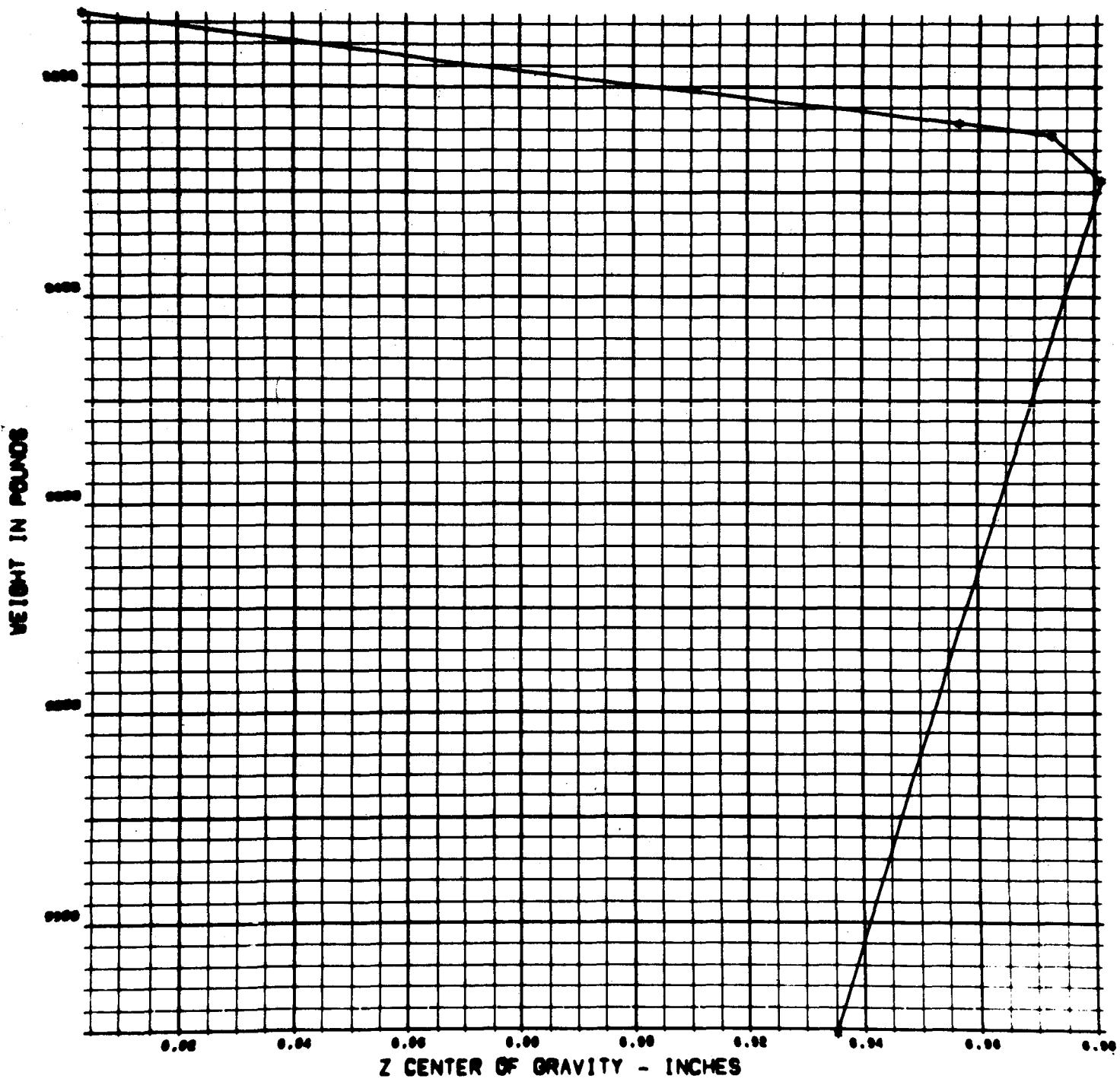
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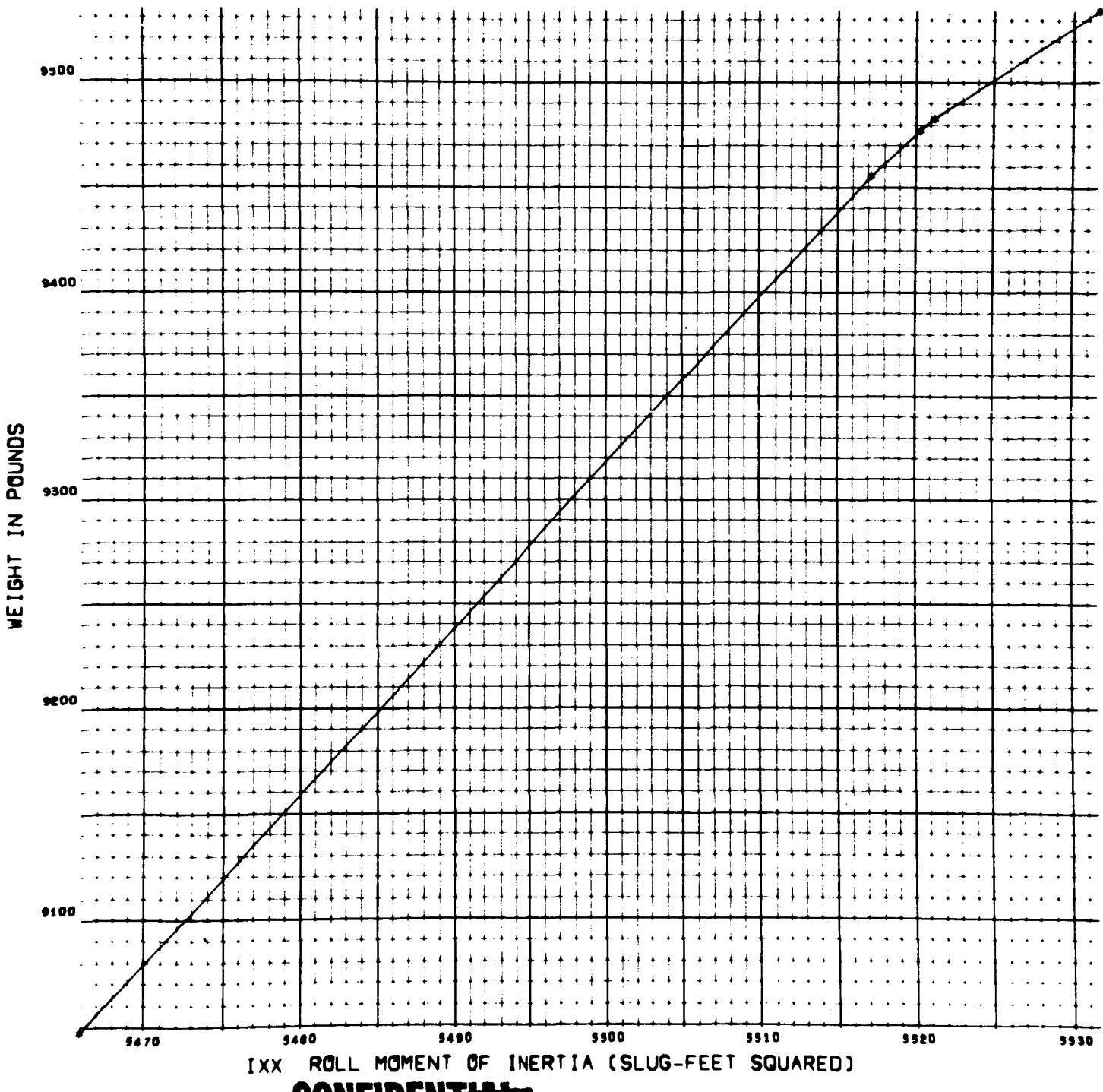
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094 000



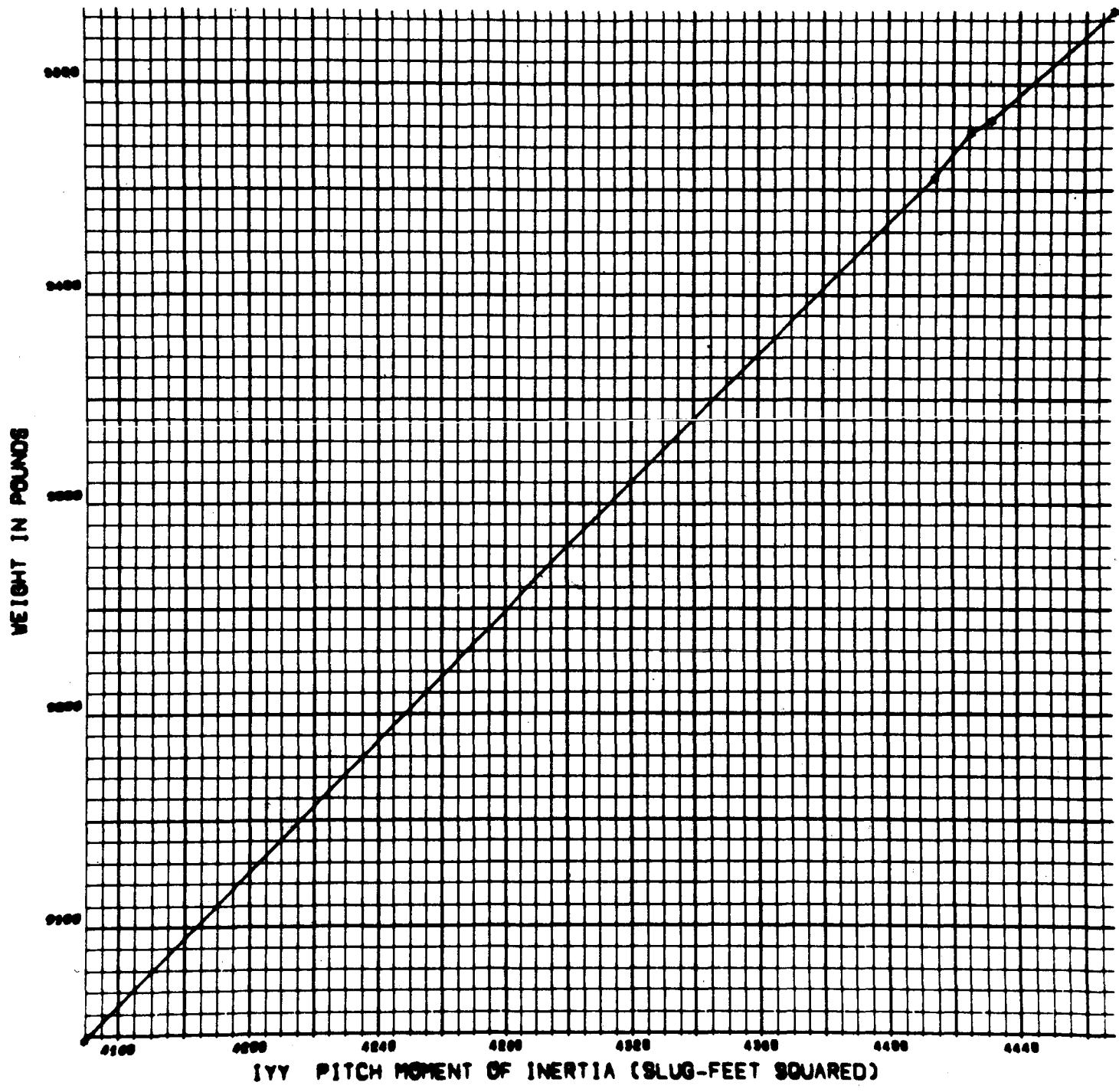
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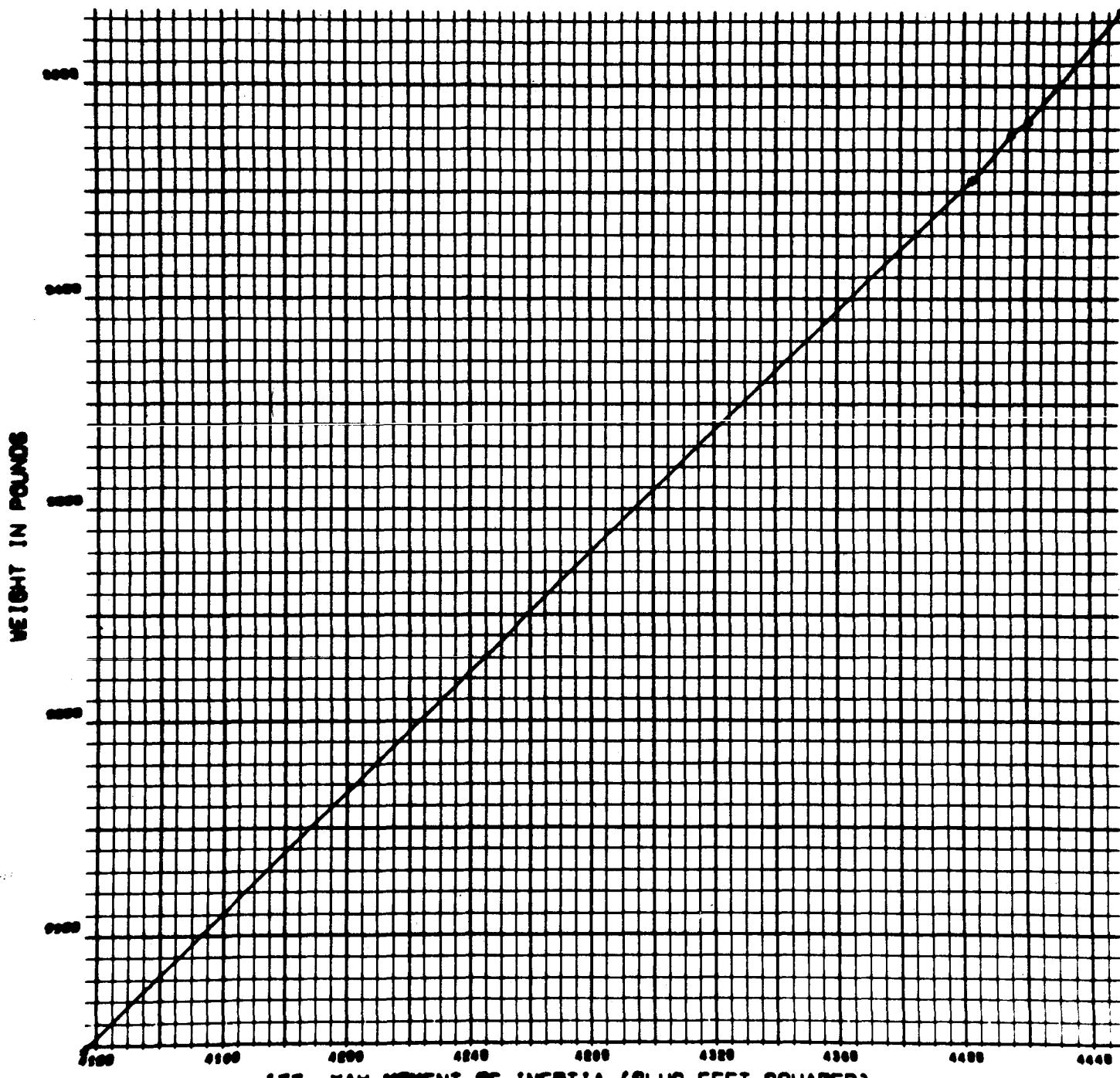
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BP 23 COMMAND MODULE DESCENT PHASE

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IZZ TAW MOMENT OF INERTIA (SLUG-FEET SQUARED)

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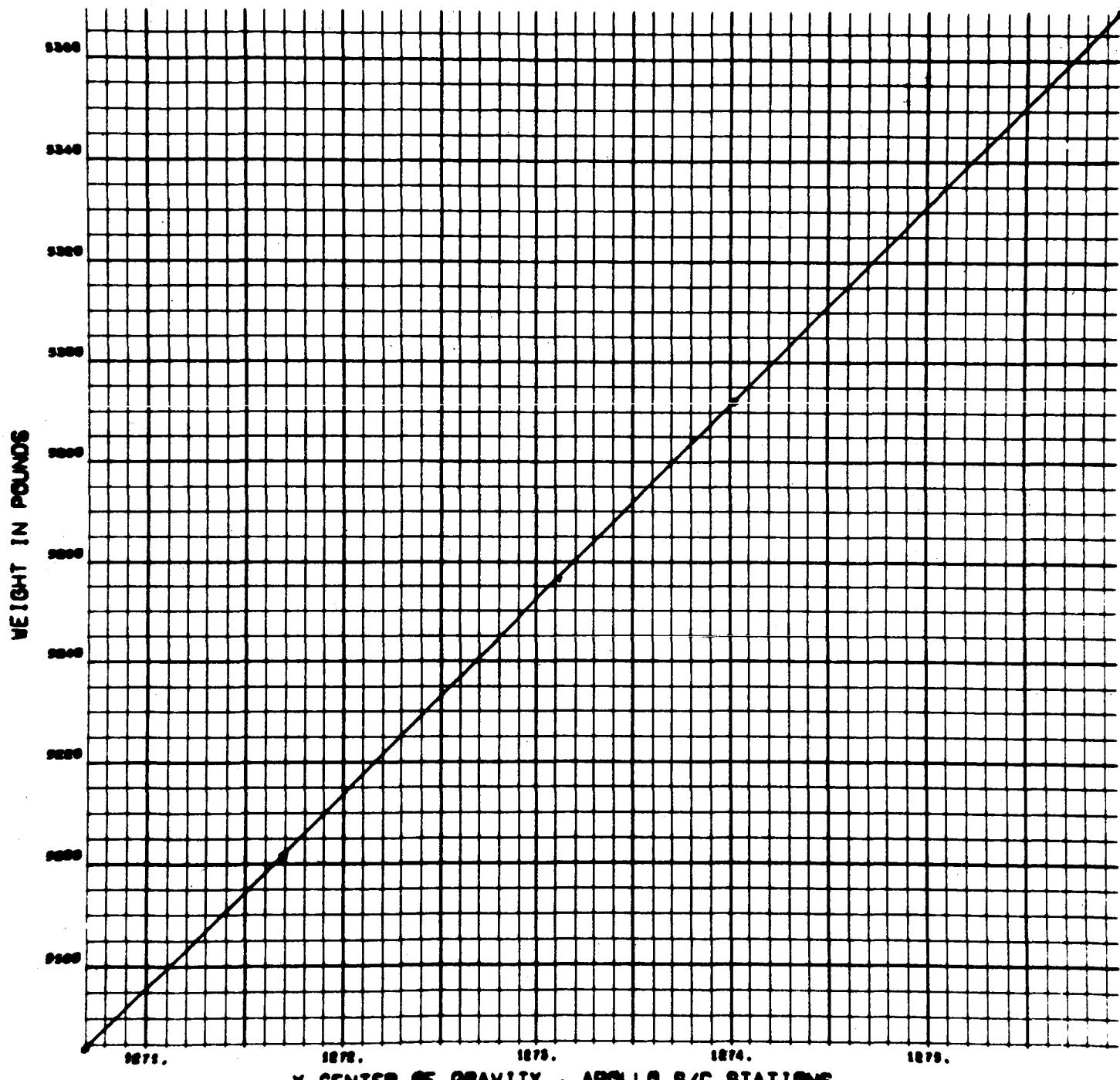
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BP 23 LAUNCH ESCAPE SYSTEM

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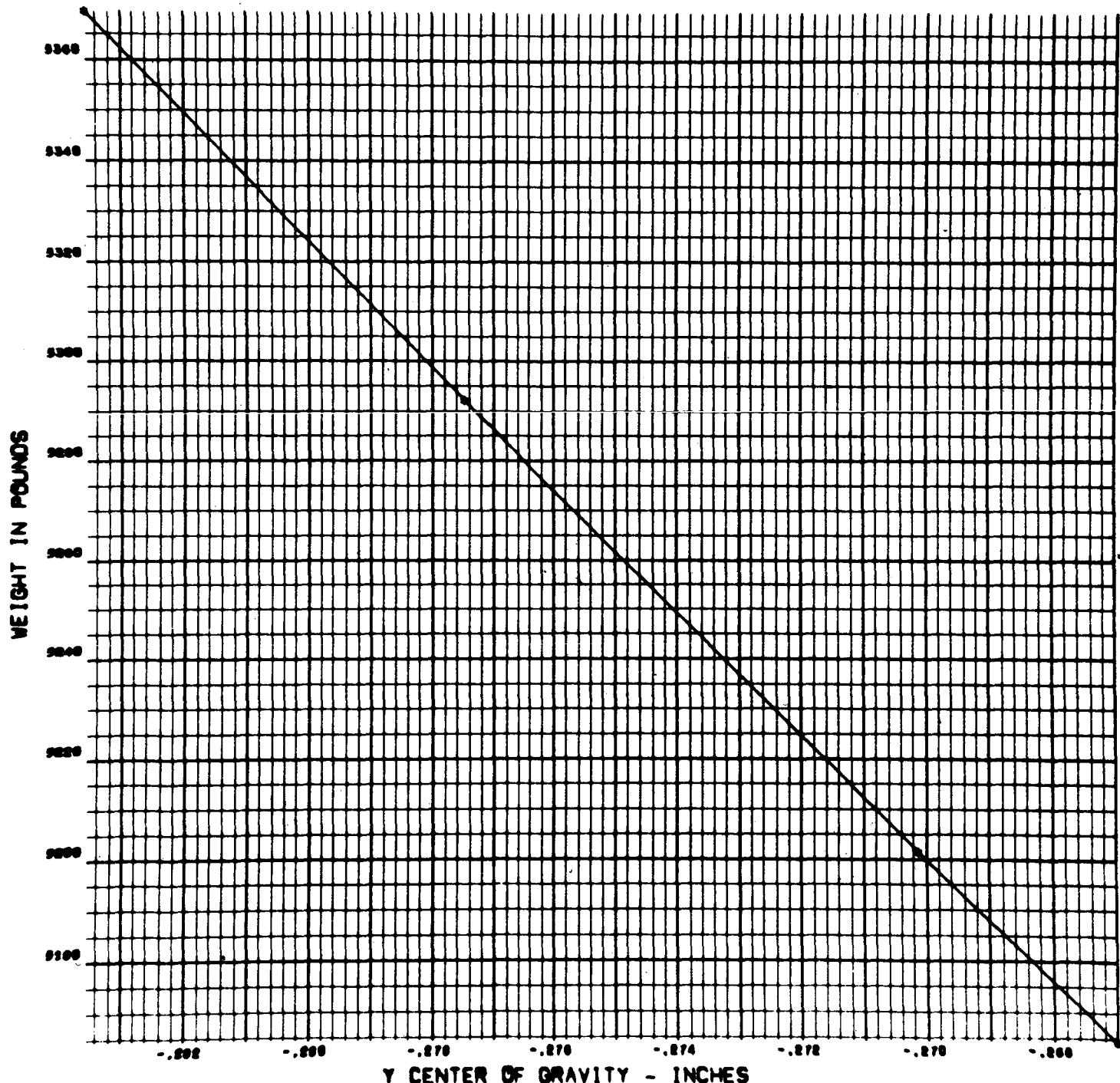
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BP 23 LAUNCH ESCAPE SYSTEM

JETTISON PHASE

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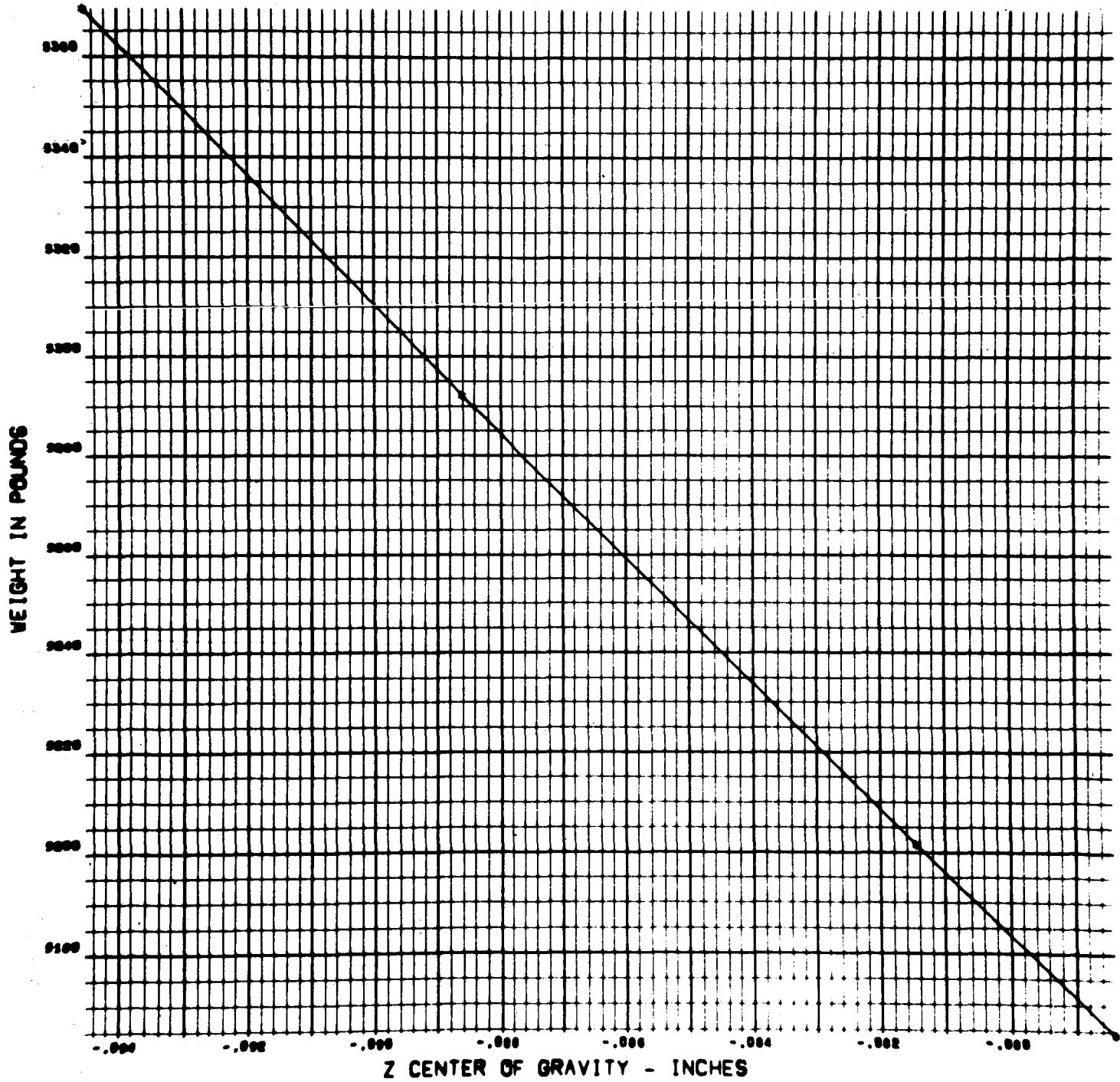
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BP 23 LAUNCH ESCAPE SYSTEM

JETTISON PHASE

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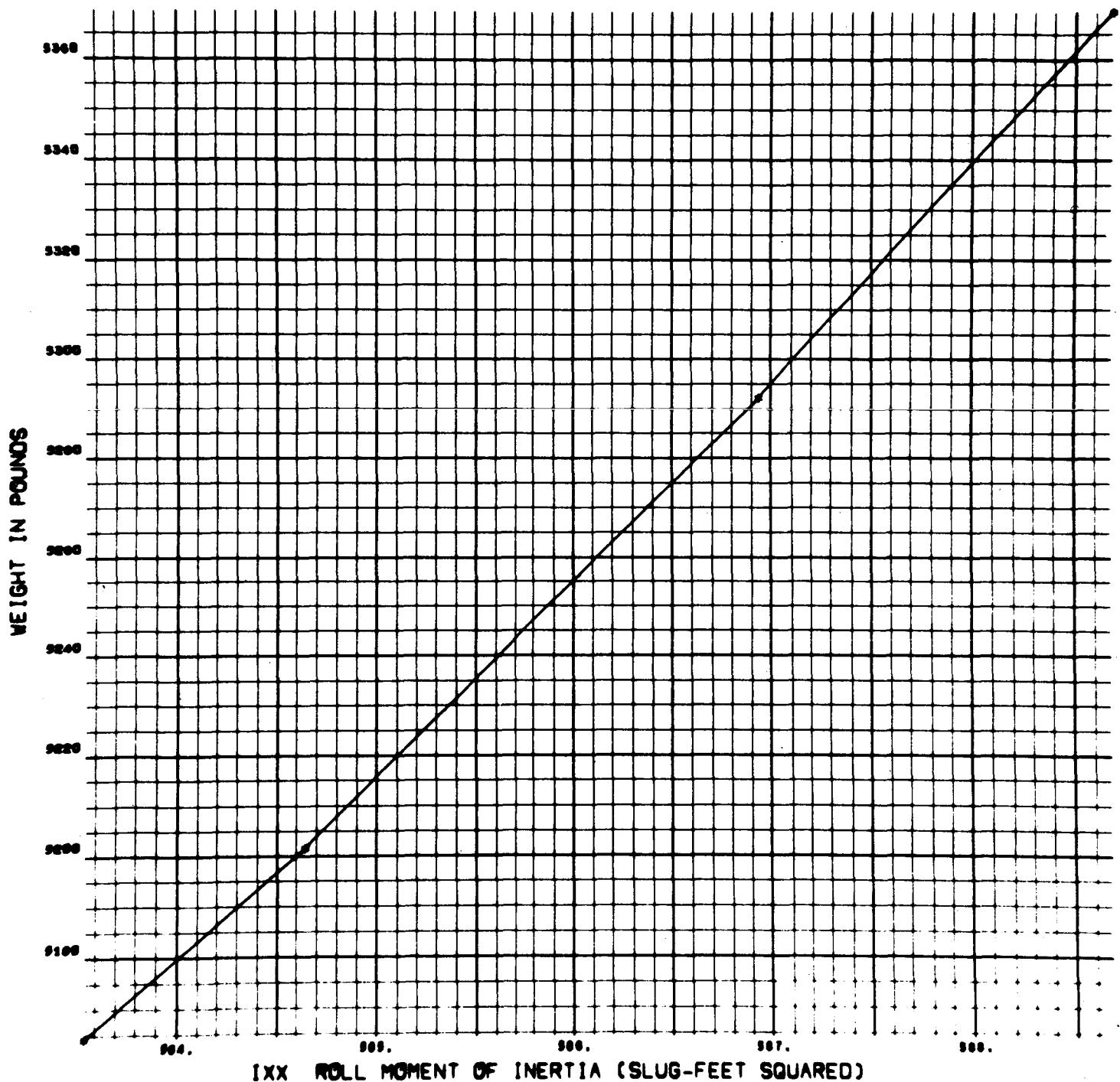
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BP 23 LAUNCH ESCAPE SYSTEM

JETTISON PHASE

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IXX ROLL MOMENT OF INERTIA (SLUG-FEET SQUARED)

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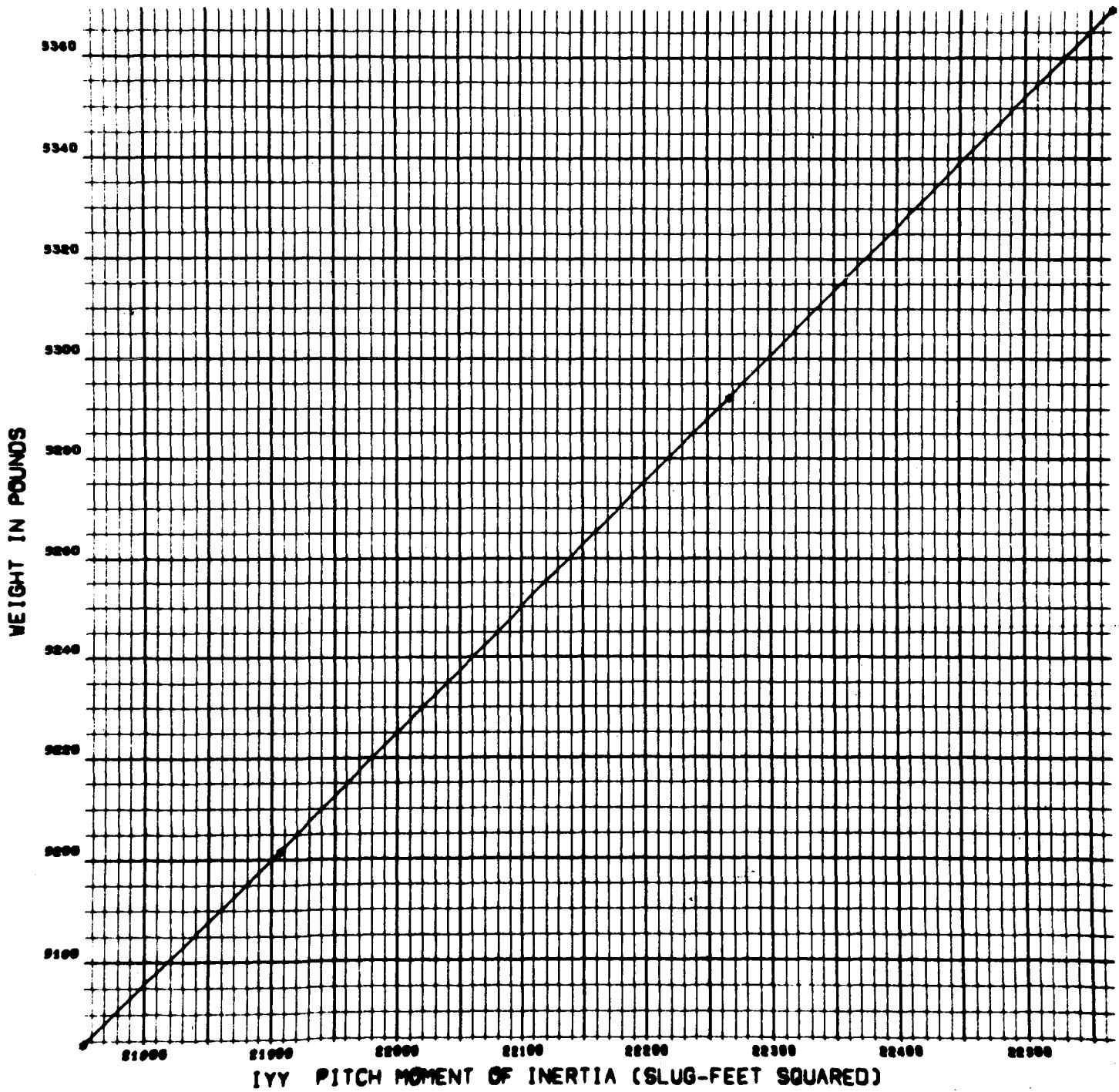
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BP 23 LAUNCH ESCAPE SYSTEM

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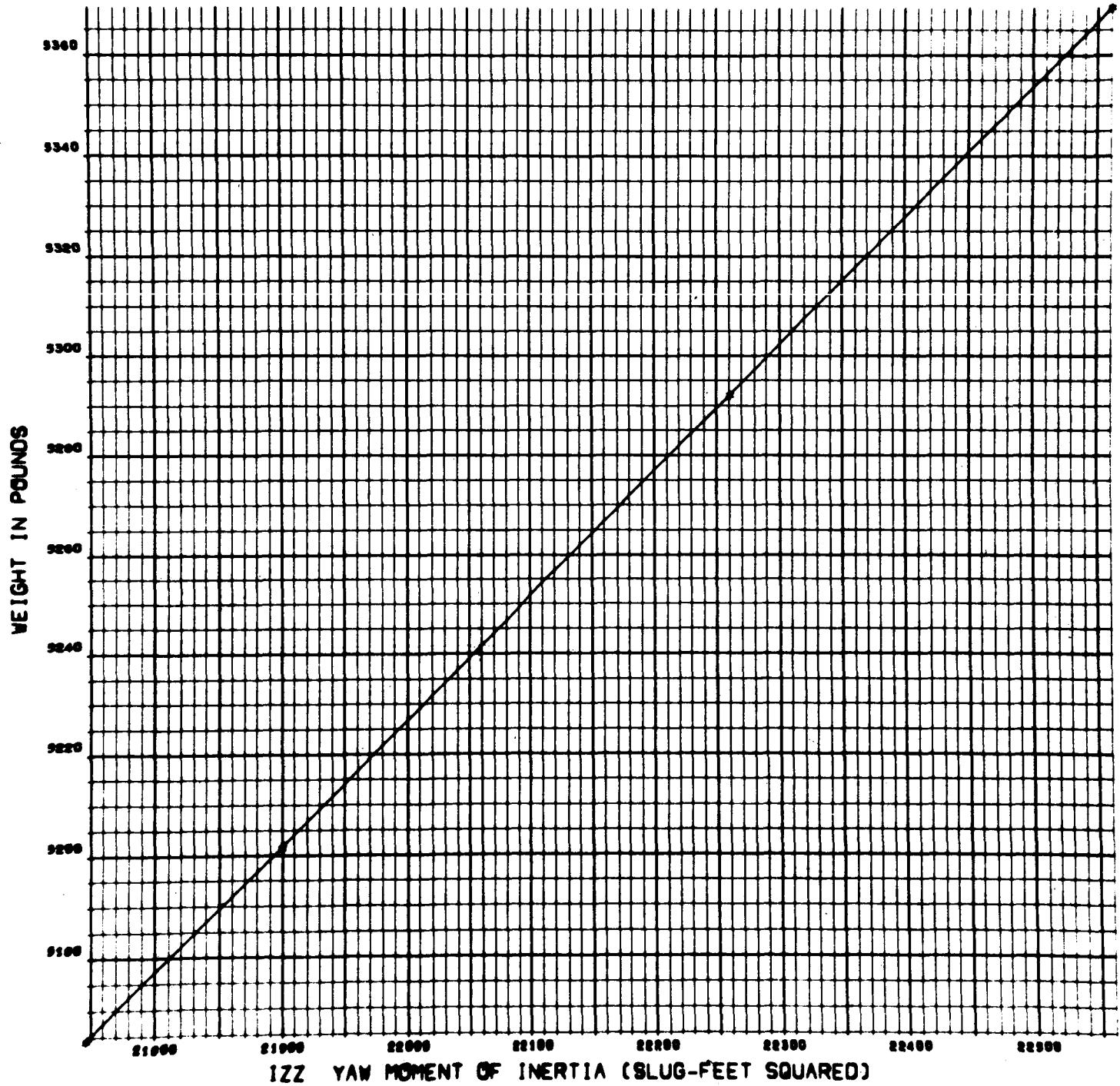
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BP 23 LAUNCH ESCAPE SYSTEM

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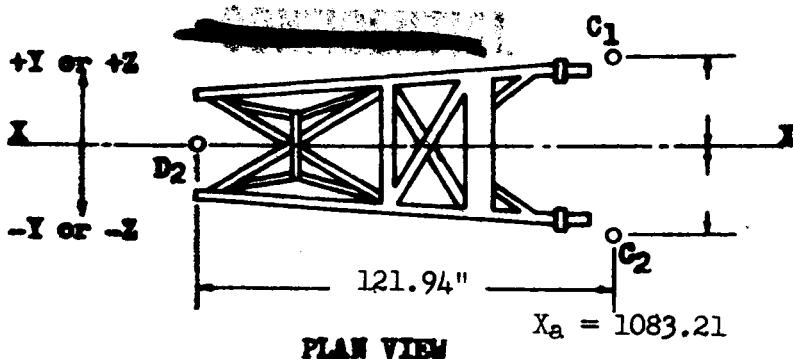
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## WEIGHT AND BALANCE DATA SHEET

## LAUNCH ESCAPE SYSTEM - TOWER ASSEMBLY

HORIZONTAL (ONLY)



Vehicle No. Boilerplate No. 23

Recorded By K. L. Beets

Location VAB - WSMR

Date Performed 10-1-64

REACTION POINT D<sub>2</sub>

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Red	8850	200	8650	
2	S/N 20336	8849	197	8652	
3		8845	200	8645	
					8649

REACTION POINT C<sub>2</sub>

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Yellow	12218	200	12018	
2	S/N 20338	12220	201	12019	
3		12225	199	12026	
					12021

REACTION POINT C<sub>1</sub>

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Blue	11686	199	11487	
2	S/N 20341	11675	201	11474	
3		11675	200	11475	
					11479

VERIFIED BY:

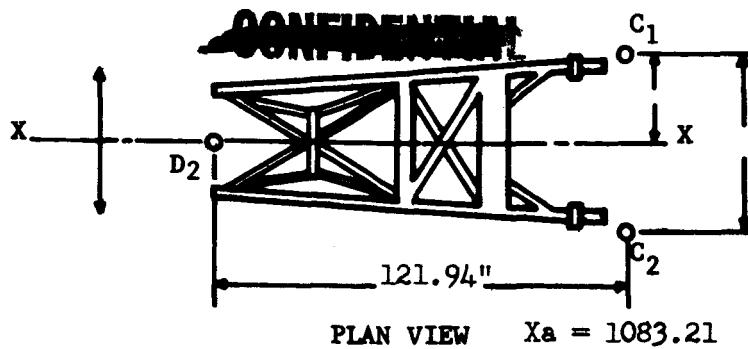
  
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## WEIGHT AND BALANCE CALCULATION SHEET

## LAUNCH ESCAPE SYSTEM - TOWER ASSEMBLY

HORIZONTAL (ONLY)



Vehicle No. Boilerplate No. 23

Recorded By K. L. Beets

Location VAB - WSMR

Date Performed 10-1-64

## WEIGHT DERIVATION

REACT POINT	LOAD CELL	AVERAGE READING	INDICATED WEIGHT	BUOYANCY CORRECTION	GRAVITY CORRECTION	WEIGHT
D2	Red	8649.0	215.4	-0.03	+0.21	215.58
C2	Yellow	12021.0	299.3	-0.04	+0.30	299.56
C1	Blue	11479.0	286.2	-0.04	+0.58	286.74

## WEIGHT AND X - Y CENTER OF GRAVITY

DESCRIPTION	REACT POINT	WEIGHT	X STA	X MOMENT	STA	MOMENT
Cell Location	D2	215.6	1205.15	259830		
Cell Location	C2	299.6	1083.21	324530		
Cell Location	C1	286.7	1083.21	310556		
GROSS (as weighed)		801.9	1115.99	894916		
LESS: G15-810013-31 "X" Frame		-315.0	1083.19	-341205		
LESS: G15-810155 Fwd. Support		-7.4	1205.15	-8918		
LESS: "X" Frame Attach Hwr.		-6.5	1083.21	-7041		
PLUS: Air Buoyancy		0.1	1136.90	114		
NET (As Weighed)		473.1	1136.90	537866		
PLUS: Corrections-Page 25 (Less Bst Cvr)		53.0	1168.20	61915		
TOTAL TOWER - Less Boost Cover		526.1	1140.05	599781		
PLUS: Boost Cover - Page 25		578.5	1070.1	619053		
<b>CORRECTED WEIGHT AND CG (X-Y)</b>		<b>1104.6</b>	<b>1103.4</b>	<b>1218834</b>		

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CORRECTIONS TO ACTUAL WEIGHT AND BALANCE

LAUNCH ESCAPE TOWER

BOILERPLATE NO. 23

ITEM	±	WEIGHT	LONGITUDINAL
			X <sub>a</sub>
Dual Mode Tower Feet	-	17.43	1088.6
Single Mode Tower Feet	+	18.43	1088.6
LES/CM Explosive Bolts (Partial)	+	4.90	1085.5
Tower to Apex Cover Linkage	+	1.59	1121.1
Y-9050 Tape	+	0.62	1116.4
Camera	+	17.00	1185.4
Camera Instl. (Less Camera)	+	27.40	1180.7
Tower Leg Door Covers	+	0.50	1084.0
TOTAL CORRECTIONS (Less Boost Cover)	+	53.01	1168.2
<hr/>			
Fwd. Section Boost Cover	+	245.49	1099.2
Aft Section Boost Cover	+	333.05	1048.6
TOTAL BOOST COVER	+	578.54	1070.1
TOTAL CORRECTIONS (With Boost Cover)	+	631.55	1078.3

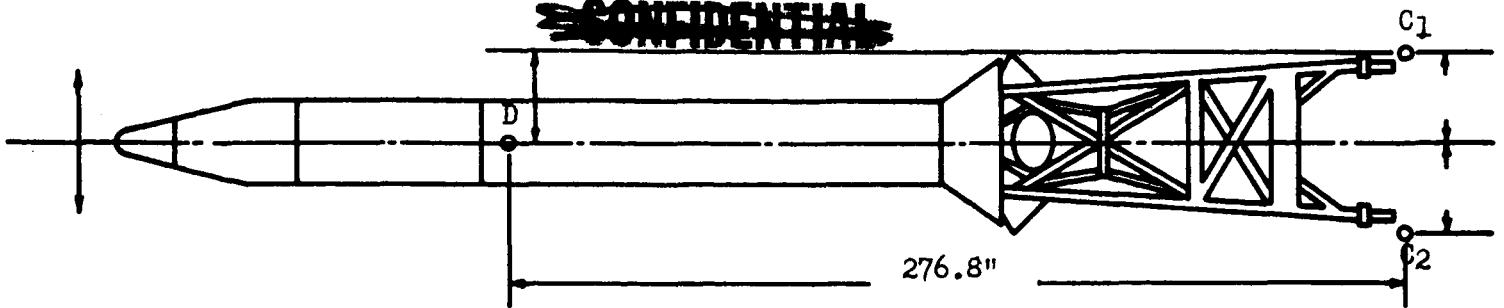
NOTE: The weight (only) of the items listed on this page represents an actual weight obtained prior to installation.

~~CONFIDENTIAL~~

## WEIGHT AND BALANCE DATA SHEET

## LAUNCH ESCAPE SYSTEM

HORIZONTAL (ONLY)

~~CONFIDENTIAL~~

Xa = 1083.21

Vehicle No. Boilerplate No. 23

Recorded By V. V. Sheeley/L.E. Kessler

Location VAB-WSMR

Date Performed 10-8-64

REACTION POINT C<sub>1</sub> (Compression)

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Blue	32929.0	297.5	32631.5	
2	S/N 20341	32989.0	295.0	32694.0	
3	1000 Cap.	33051.0	295.0	32756.0	
					32694.0

REACTION POINT C<sub>2</sub> (Compression)

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Yellow	33308.0	298.0	33010.0	
2	S/N 20338	33259.0	295.0	32964.0	
3	1000 Cap.	33235.0	296.0	32939.0	
					32971.0

## REACTION POINT D (Compression)

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Red	25053.0	293.0	27760.0	
2	S/N 34215	25059.5	300.0	24759.5	
3	10000 Cap.	25057.5	300.0	24757.5	
					24759.0

VERIFIED BY:

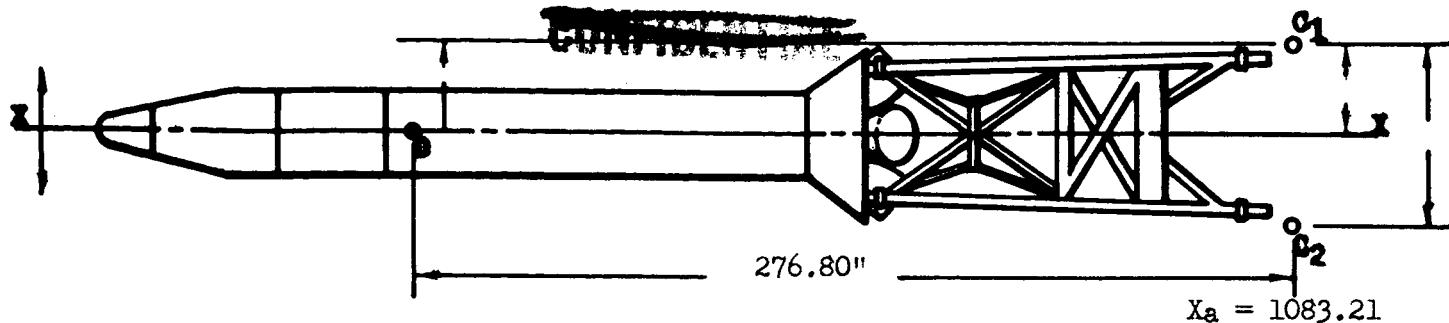
*H. Miller*

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## WEIGHT AND BALANCE CALCULATION SHEET

## LAUNCH ESCAPE SYSTEM



PLAN VIEW

Vehicle No. Boilerplate No. 23

Recorded By V.V. Sheeley/J.F. Kessler

Location VAB-WSMR

Date Performed 10-8-64

## WEIGHT DERIVATION

REACT POINT	LOAD CELL	AVERAGE READING	INDICATED WEIGHT	BUOYANCY CORRECTION	GRAVITY CORRECTION	WEIGHT
C1	Blue	32694.0	813.7	-0.1	+0.8	814.4
C2	Yellow	32791.0	819.5	-0.1	+0.8	820.2
D	Red	24759.0	6256.9	-0.9	+6.2	6262.2

## WEIGHT AND X CENTER OF GRAVITY

DESCRIPTION	REACT POINT	WEIGHT	X STA	X MOMENT
Cell Location	C1	814.4	1083.21	882166
Cell Location	C2	820.2	1083.21	888449
Cell Location	D	6262.2	1360.01	8516655
GROSS (as weighed)		7896.8	1302.71	10287270
LESS: G15-810013-31 "X" Frame		-315.0	1083.19	-341205
LESS: Attaching Hwr.		-6.5	1083.21	-7041
LESS: G15-810091 Saddle		-83.4	1360.14	-113436
LESS: Nozzle Covers		-3.8	1198.00	-4552
LESS: Ground Wire & Clamp		-2.0	1430.00	-2860
PLUS: Air Buoyancy		3.5	1317.80	4612
Net (As Weighed)		7489.6	1311.52	9822788
PLUS: Corrections - Page 28		655.3	1086.80	712180
CORRECTED WEIGHT AND CG (X)		8144.9	1293.44	10534968



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CORRECTIONS TO ACTUAL WEIGHT AND BALANCE

LAUNCH ESCAPE SYSTEM

BOILERPLATE NO. 23

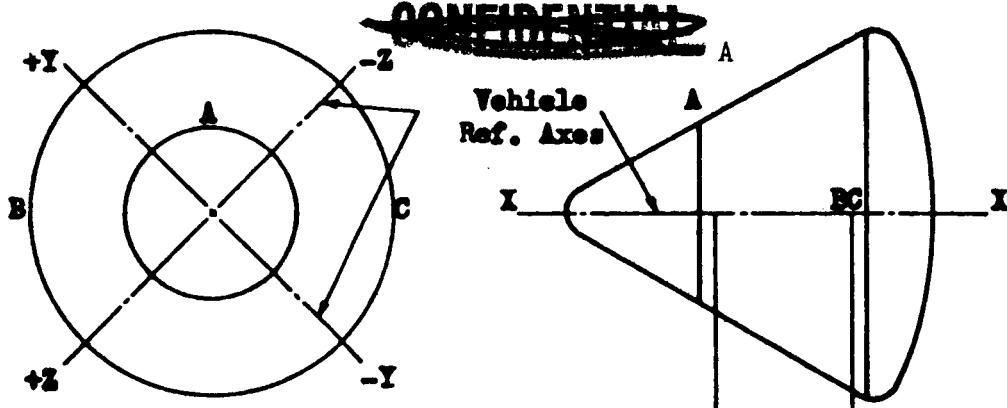
ITEM	±	WEIGHT	CENTER OF GRAVITY		
			Xa	Ya	Za
Dual Mode Tower Feet	-	17.43	1088.6	0.0	0.0
Single Mode Tower Feet	+	18.43	1088.6	0.0	0.0
LES/CM Explosive Bolts (Partial)	+	4.90	1085.5	0.0	0.0
Tower to Apex Cover Linkage	+	1.59	1121.0	0.0	0.0
Cable Clamps (4)	+	0.20	1205.0	0.0	0.0
Canard Link Assy.	+	6.76	1440.9	0.0	-7.0
Canard Position Pot. Instl.	+	0.50	1439.6	-2.5	-8.0
Canard Thruster Assy.	-	36.60	1439.0	0.0	4.4
Canard Thruster Assy.	+	36.94	1439.0	0.0	4.4
Y-9050 Tape	+	0.62	1116.4	0.0	0.0
Fwd. Section - Boost Cover	+	245.49	1099.2	0.0	-0.3
Aft Section - Boost Cover	+	333.05	1048.6	-1.0	-1.0
Camera	+	17.00	1185.4	0.0	0.0
Camera Instl. (Less Camera)	+	40.40	1191.1	-0.3	5.1
Ordnance Instl. (Canard & Motor)	+	2.90	1424.2	0.0	0.0
Tower Leg Door Covers	+	0.50	1084.0	0.0	0.0
 TOTAL LES CORRECTIONS	 +	 655.25	 1086.8	 -0.5	 -0.4

NOTE: The weight (only) of the items indicated represents an actual weight obtained prior to installation.

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## WEIGHT AND BALANCE DATA SHEET

## COMMAND MODULE - HORIZONTAL



$$X_a = 1079.05 \quad 1028.44$$

Vehicle No. Boilerplate No. 23Recorded By K. L. Beets/J. F. KesslerLocation VAB - WSMRDate Performed 10-6-64

## REACTION POINT A (TENSION)

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Red	13160.5	295.0	12865.5	
2	S/N 34215	13191.0	297.5	12893.5	
3		13158.5	293.5	12865.0	
					12874.7

## REACTION POINT B (COMPRESSION)

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Yellow	15120.0	298.0	14822.0	
2	S/N 34210	15125.0	299.5	14825.5	
3		15112.0	299.5	14812.5	
					14820.0

## REACTION POINT C (COMPRESSION)

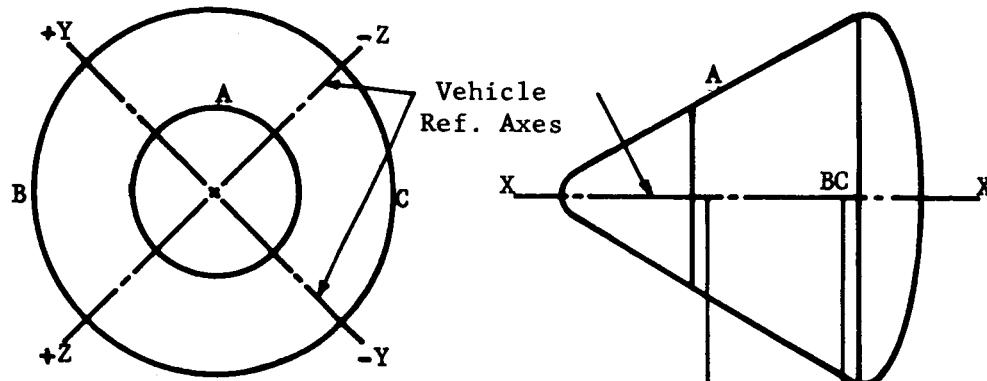
DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Blue	12887.0	297.5	12589.5	
2	S/N 34214	12860.0	300.0	12560.0	
3		12892.5	300.0	12592.5	
					12580.7

VERIFIED BY:

  
NASA

## WEIGHT AND BALANCE CALCULATION SHEET

COMMAND MODULE - HORIZONTAL

~~CONFIDENTIAL~~

$$X_a = 1079.05 \quad 1028.44$$

Recorded By K. L. Beets/J. F. Kessler

Vehicle No. Boilerplate No. 23

Location VAB - WSMR

Date Performed 10-6-64

## WEIGHT DERIVATION

REACT POINT	LOAD CELL	AVERAGE READING	INDICATED WEIGHT	BUOYANCY CORRECTION	GRAVITY CORRECTION	WEIGHT
A	Red	12874.7	3233.4	-0.5	+3.2	3236.1
B	Yellow	14820.0	3741.3	-0.6	+3.7	3744.4
C	Blue	12580.7	3174.4	-0.5	+3.2	3177.1

## WEIGHT AND X CENTER OF GRAVITY

DESCRIPTION	REACT POINT	WEIGHT	X STA	X MOMENT
Cell Location	A	3236.1	1079.05	3491914
Cell Location	B	3744.4	1028.44	3850891
Cell Location	C	3177.1	1028.44	3267457
GROSS (as weighed)		10157.6	1044.56	10610262
Less: HL4-9006 Sling & Trunnions		-294.7	1079.05	-317996
Less: (3) GL6-810007 Aft Jack Pads		-37.9	1028.44	-38978
Less: (4) Apex Cover Hold Down Bolts		-5.9	1081.10	-6378
Plus: Air Buoyancy		6.7	1043.57	6992
Net (as weighed)		9825.8	1043.57	10253902
Plus: Corrections - Page 34		150.8	1037.2	156410
<b>CORRECTED WEIGHT AND CG (X)</b>		<b>9976.6</b>	<b>1043.47</b>	<b>10410312</b>

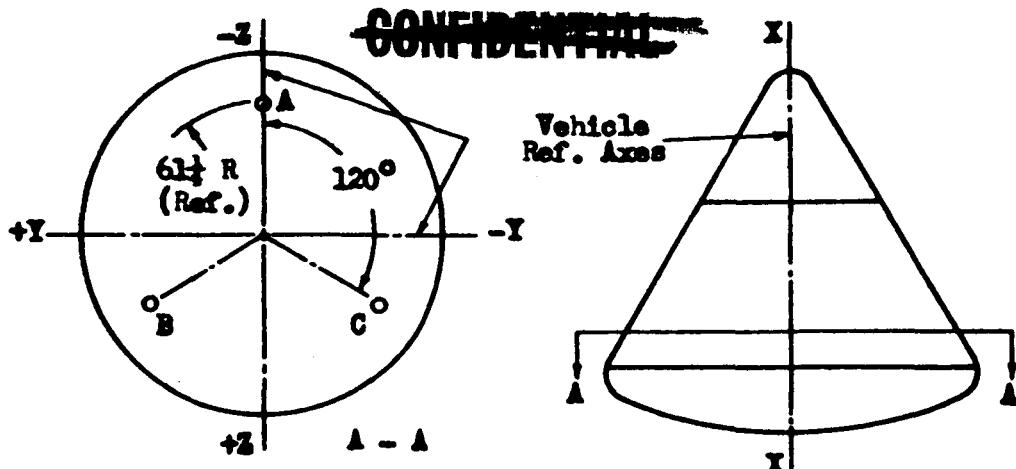
~~CONFIDENTIAL~~

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SID 63-143-12W

## WEIGHT AND BALANCE DATA SHEET

## COMMAND MODULE - VERTICAL

Vehicle No. Boilerplate No. 23Recorded By K. L. Beets/J. E. KesslerLocation VAB - WSMRDate Performed 10-7-64

## REACTION POINT A (COMPRESSION)

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Red	11259.0	298.5	10960.5	
2	S/N 34215	11254.5	298.5	10956.0	
3		11258.5	298.0	10960.5	
					10959.0

## REACTION POINT B (COMPRESSION)

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Yellow	15395.0	296.5	15098.5	
2	S/N 34210	15401.0	302.0	15099.0	
3		15402.0	298.5	15103.5	
					15100.3

## REACTION POINT C (COMPRESSION)

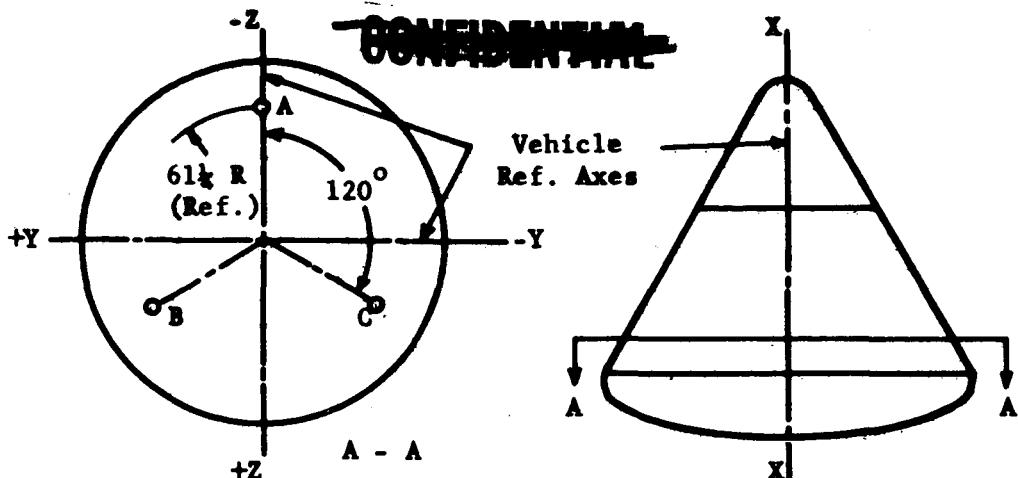
DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Blue	14972.0	298.5	14673.5	
2	S/N 34211	14972.0	299.0	14673.0	
3		14964.0	297.5	14666.5	
					14671.0

VERIFIED BY:

*Hessler*  
NASA~~CONFIDENTIAL~~

## WEIGHT AND BALANCE CALCULATION SHEET

## COMMAND MODULE - VERTICAL

Vehicle No. Boilerplate No. 23Recorded By K. L. Beets/J. F. KesslerLocation VAB-WSMRDate Performed 10-7-64

## WEIGHT DERIVATION

REACT POINT	LOAD CELL	AVERAGE READING	INDICATED WEIGHT	BUOYANCY CORRECTION	GRAVITY CORRECTION	WEIGHT
A	Red	10959.0	2763.0	-0.4	+2.8	2765.4
B	Yellow	15100.3	3812.3	-0.6	+3.8	3815.5
C	Blue	14671.0	3702.2	-0.6	+3.7	3705.3

## WEIGHT AND Y - Z CENTER OF GRAVITY

DESCRIPTION	REACT POINT	WEIGHT	Y STA	Y MOMENT	Z STA	Z MOMENT
Cell Location	A	2765.4	0.00	-	-61.24	-169353
Cell Location	B	3815.5	53.02	202298	30.65	116945
Cell Location	C	3705.3	-52.99	-196344	30.65	113567
GROSS (as weighed)		10286.2	0.58	5954	5.95	61159
Less: H14-017 Ring		-470.4	0.62	-292	-0.50	235
Plus: Air Buoyancy		6.7	0.58	4	6.26	42
NET (as weighed)		9822.5	0.58	5666	6.25	61436
Plus: Corrections - Page 34		150.8	-4.80	-724	29.70	4479
CORRECTED WEIGHT AND CG (Y-Z)		9973.3	0.50	4942	6.61	65915

## WEIGHT AND BALANCE DATA SHEET

COMMAND MODULE

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## SINGLE CELL TENSION WEIGHING

Vehicle No. Boilerplate No. 23 Recorded By K. L. Beets/J. F. KesslerLocation VAB - WSMR Date Performed 10-6-64

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING
1	Red	40060.0	300.0	39760.0
2	S/N 34215	40064.0	299.0	39765.0
3		40065.5	299.0	39766.5

AVERAGE READING 39763.8INDICATED WEIGHT 9958.7BUOYANCY CORRECTION (6.7 -1.5) +5.2GRAVITY CORRECTION +9.9GROSS WEIGHT (as weighed) 9973.8Less: HL4-9001 Sling -97.1Less: HL4-9001 Lifting Pads -40.3Less: (4)Apex Cover Hold Down Bolts - 5.9NET WEIGHT (as weighed) 9830.5Plus: Corrections - Page 34 +150.8CORRECTED WEIGHT 9981.3

VERIFIED BY:

*Herrill*  
NASA~~CONFIDENTIAL~~

CORRECTIONS TO ACTUAL WEIGHT AND BALANCECOMMAND MODULEBOILERPLATE NO. 23

ITEM	±	WEIGHT	CENTER OF GRAVITY		
			Xa	Ya	Za
Ballast - Aft Heat Shield	+	40.97	1013.7	-19.0	62.4
Ballast - Aft Heat Shield	+	20.95	1013.7	-4.8	65.7
Ballast - Aft Heat Shield	+	20.22	1013.7	19.5	62.9
LES/CM Tower Attach Nuts & Bolts	+	3.40	1080.9	0.0	0.0
CM/SM Tension Tie Straps (Partial)	+	2.44	1015.3	0.0	0.0
Hoist Ftg Plugs & Patching	+	6.75	1061.0	0.0	0.0
Camera Cable Clamps & Xducer Line	+	0.65	1075.0	15.0	-15.0
Mission Sequencer	+	29.60	1043.0	-44.2	11.5
Main Battery Electrolyte	+	7.90	1018.0	0.0	38.1
(4) Pyro Batteries Electrolyte	+	3.30	1018.0	0.0	38.5
(2) Pyro Batteries Electrolyte	+	1.70	1040.6	48.0	0.0
Camera	+	17.80	1124.0	0.0	-0.8
Camera Generator	+	2.20	1033.6	29.4	-45.3
Camera Battery	+	7.80	1028.4	45.4	-27.3
Camera Control Unit	+	3.20	1025.4	28.9	-44.4
Camera MO-3 Mount	+	1.30	1124.0	0.0	-0.8
Camera Control Unit Bracket	+	2.60	1025.4	28.9	-44.4
Dehumidifying Bags	-	22.00	1029.2	-17.8	40.8
Total C/M Corrections	+	150.78	1037.2	-4.8	29.7

NOTE: All corrections items listed above, except for the mission sequencer and LES/CM Tower attach nuts and bolts, represent and actual weight (only) obtained prior to installation.

~~CONFIDENTIAL~~WEIGHT AND CENTER OF GRAVITY SUMMARYCOMMAND MODULEBOILERPLATE NO. 23

ITEM	WEIGHT	CENTER OF GRAVITY		
		Xa	Ya	Za
Horizontal Weighing (Page 30)	9976.6	1043.47	-	-
Vertical Weighing (Page 32)	9973.3	-	0.50	6.61
Command Module (Average)	9975.0	1043.5	0.5	6.6

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WEIGHT AND BALANCE SUMMARY

SERVICE MODULE

BOILERPLATE NO. 23

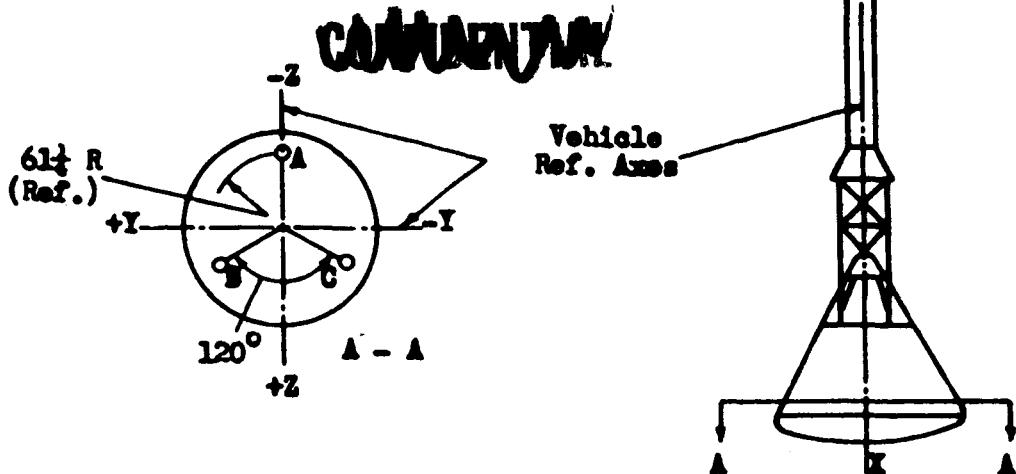
ITEM	±	WEIGHT	CENTER OF GRAVITY		
			Xa	Ya	Za
*S/M-(Act. Wt & Bal. Rpt SID 63-143-12)		9515.2	932.6	-0.7	-7.5
Less: Calc. Camera Instl. (Less Camera)	-	61.1	926.5	15.9	-11.6
Plus: Act. Camera Instl. (Less Camera)	+	64.8	926.5	15.9	-11.6
Less: Rubber Bumper	-	3.6	1017.8	0.0	0.0
Plus: Rubber Bumper Mod.	+	5.3	1017.8	0.0	0.0
Plus: Tension Tie Straps (Partial)	+	2.4	1007.3	0.0	0.0
Service Module Corrected Wt. & C.G.		9523.0	932.6	-0.7	-7.5

NOTE: \*Service Module Total indicated is as referenced in the Actual Weight and Balance Report SID 63-143-12, dated 5 October 1964.

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## WEIGHT AND BALANCE DATA SHEET

## LAUNCH ESCAPE SYSTEM-COMMAND MODULE COMBINED

Vehicle No. BOILERPLATE NO. 23Recorded By K. L. Beets / J. F. KesslerLocation VAB - WSMRDate Performed 10-12-64

## REACTION POINT - A

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Red	21113.5	299.0	20814.5	
2	S/N 34215	21115.0	299.0	20816.0	
3		21127.5	299.0	20828.5	
					20819.7

## REACTION POINT - B

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Yellow	25523.0	300.5	25222.5	
2	S/N 34210	25516.5	300.0	25216.5	
3		25510.5	300.0	25210.5	
					25216.5

## REACTION POINT - C

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Blue	25098.5	300.5	24798.0	
2	S/N 34214	25103.5	301.0	24802.5	
3		25095.0	300.0	24795.0	
					24798.5

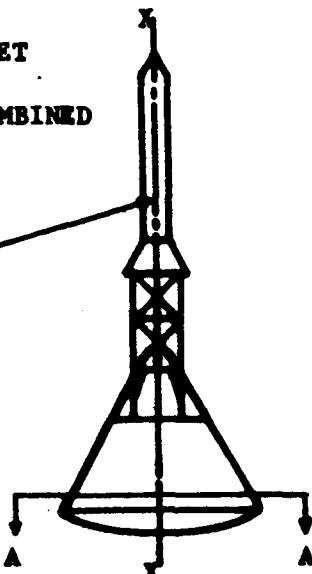
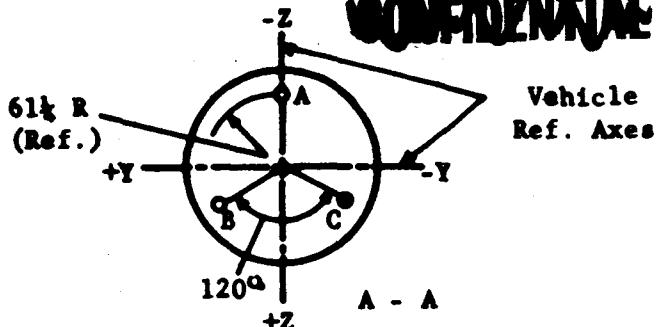
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## INITIAL DETERMINATION

## WEIGHT AND BALANCE CALCULATION SHEET

## LAUNCH ESCAPE SYSTEM-COMMAND MODULE COMBINED

~~CONFIDENTIAL~~

Vehicle No. Boilerplate No. 23

Recorded By K. L. Resta/J. F. Kessler

Location VAB - WSMR

Date Performed 10-12-64

## WEIGHT DERIVATION

REACT POINT	LOAD CELL	AVERAGE READING	INDICATED WEIGHT	BUOYANCY CORRECTION	GRAVITY CORRECTION	WEIGHT
A	Red	20819.7	5257.7	-0.8	+5.2	5262.1
B	Yellow	25216.5	6378.3	-1.0	+6.4	6383.7
C	Blue	24798.5	6267.0	-0.9	+6.2	6272.3

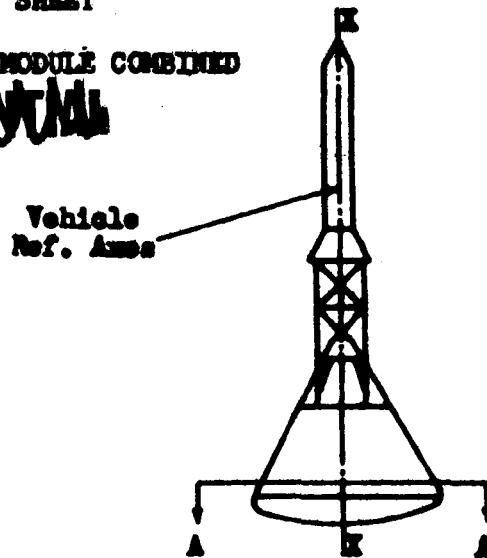
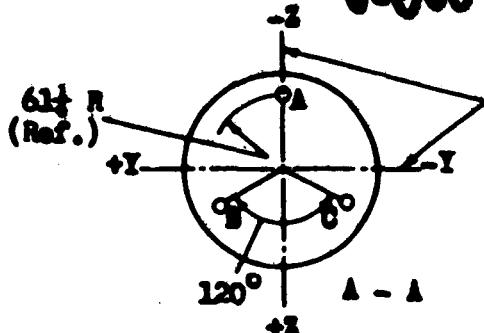
## WEIGHT AND Y - Z CENTER OF GRAVITY

DESCRIPTION	REACT POINT	WEIGHT	Y STA	Y MOMENT	Z STA	Z MOMENT
Cell Location	A	5262.1	0.00	-	-61.24	-322251
Cell Location	B	6383.7	53.02	338464	30.65	195660
Cell Location	C	6272.3	-52.99	-332369	30.65	192246
GROSS (as weighed)		17918.1	0.34	6095	3.66	65655
Less: HL4-017 Ring		-470.4	0.62	-292	-0.50	235
Less: HL4-007 Alignment Grid		-23.3	0.00	-	3.00	-70
Less: HL4-007 Projector & Mt.		-25.8	0.00	-	0.90	-23
Plus: Air Buoyancy		9.6	0.00	-	1.00	10
Net (as weighed)		17408.2	0.33	5803	3.78	65807
Plus: Corrections - Page 41		713.0	-0.82	-585	-1.37	-977
<b>CORRECTED WEIGHT AND CG (Y-Z)</b>		<b>18121.2</b>	<b>0.29</b>	<b>5218</b>	<b>3.58</b>	<b>64830</b>

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## WEIGHT AND BALANCE DATA SHEET

## LAUNCH ESCAPE SYSTEM-COMMAND MODULE COMBINED

~~CONFIDENTIAL~~

Vehicle No. Boilerplate No. 23

Recorded By K. L. Reata / J. F. Kessler

Location VAB - WSMR

Date Performed 10-13-64

## REACTION POINT - A

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Red	21207.5	296.0	20911.5	
2	S/N 34215	21203.0	294.0	20909.0	
3		21197.5	299.0	20898.5	
					20906.3

## REACTION POINT - B

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Yellow	25332.0	295.0	25037.0	
2	S/N 34210	25341.5	297.0	25044.5	
3		25368.0	299.0	25069.0	
					25050.2

## REACTION POINT - C

DETERMINATION NUMBER	LOAD CELL	GROSS READING	ZERO READING	CORRECTED READING	AVERAGE READING
1	Blue	25176.0	297.0	24879.0	
2	S/N 34214	25175.5	299.0	24876.5	
3		25160.5	299.0	24861.5	
					24872.3

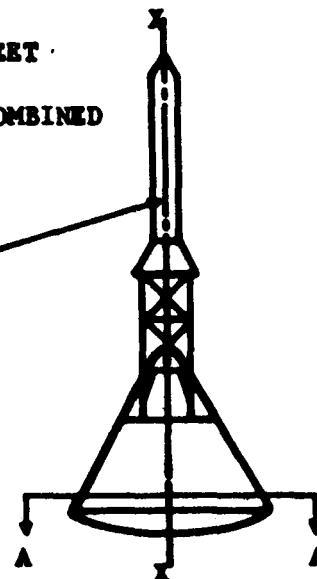
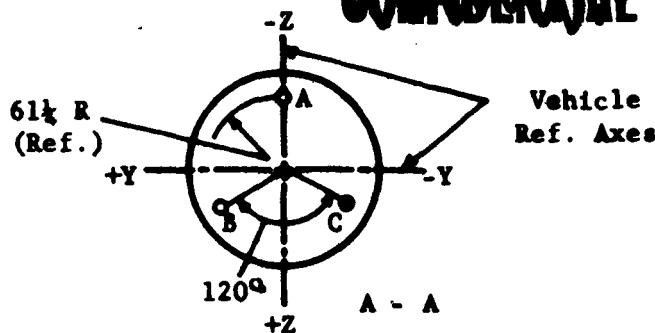
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## FINAL DETERMINATION

## WEIGHT AND BALANCE CALCULATION SHEET

LAUNCH ESCAPE SYSTEM - COMMAND MODULE COMBINED

~~CONFIDENTIAL~~

Vehicle No. Boilerplate No. 23

Recorded By K. L. Beets/J. F. Kessler

Location VAB - NSMR

Date Performed 10-13-64

## WEIGHT DERIVATION

REACT POINT	LOAD CELL	AVERAGE READING	INDICATED WEIGHT	BUOYANCY CORRECTION	GRAVITY CORRECTION	WEIGHT
A	Red	20906.3	5279.6	-0.8	+5.3	5284.1
B	Yellow	25050.2	6336.2	-1.0	+6.3	6341.5
C	Blue	24872.3	6285.7	-0.9	+6.3	6291.1

## WEIGHT AND Y - Z CENTER OF GRAVITY

DESCRIPTION	REACT POINT	WEIGHT	Y STA	Y MOMENT	Z STA	Z MOMENT
Cell Location	A	5284.1	0.00	-	-61.24	-323598
Cell Location	B	6341.5	53.02	336226	30.65	194367
Cell Location	C	6291.1	-52.99	-333365	30.65	192822
GROSS (as weighed)		17916.7	0.16	2861	3.55	63591
Less: HL4-017 Ring		-470.4	0.62	-292	-0.50	235
Less: AL4-007 Alignment Grid		-23.3	0.00	-	3.00	-70
Less: AL4-007 Projector & Mt.		-25.8	0.00	-	0.90	-23
Plus: Air Buoyancy		9.6	0.00	-	1.00	10
Net (as weighed)		17406.8	0.15	2569	3.66	63743
Plus: Corrections - Page 41		713.0	-0.82	-585	-1.37	-977
CORRECTED WEIGHT AND CG (Y-Z)		18119.8	0.11	1984	3.46	62766

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SID 63-143-12W

~~CONFIDENTIAL~~CORRECTIONS TO ACTUAL WEIGHT AND BALANCELAUNCH ESCAPE SYSTEM - COMMAND MODULEBOILERPLATE NO. 23

ITEM	±	WEIGHT	CENTER OF GRAVITY	
			Ya	Za
CM - Dehumidify Bags	-	22.00	-17.8	40.8
CM - Tension Tie Straps (Partial)	+	2.44	0.0	0.0
CM - Hoist Ftg's Plugs & Patching	+	6.75	0.0	0.0
CM - Cable Clamps & Xducer Line	+	0.65	15.0	-15.0
CM - Main Batter Electrolyte	+	7.90	0.0	38.1
CM - (4) Pyro Batteries Electrolyte	+	3.30	0.0	38.5
CM - (2) Pyro Batteries Electrolyte	+	1.70	48.0	0.0
CM - Mission Sequencer	+	29.60	-44.2	11.5
CM - Camera & MO-3 Mount	+	19.10	0.0	-0.8
CM - Camera Generator	+	2.20	29.4	-45.3
CM - Camera Battery	+	7.80	45.4	-27.3
CM - Camera Control Unit & Bracket	+	5.80	28.9	-44.4
LES - Cable Clamps	+	0.20	0.0	0.0
LES - Canard Link Assy.	+	6.76	0.0	-7.0
LES - Canard Position Pot. Instl.	+	0.50	-2.5	-8.0
LES - Canard Thruster Assy. Mod.	+	0.34	0.0	4.4
LES - Y-9050 Tape	+	0.62	0.0	0.0
LES - Fwd. Section Boost Cover	+	245.49	0.0	-0.3
LES - Aft Section Boost Cover	+	333.05	-1.0	-1.0
LES - Camera	+	17.00	0.0	0.0
LES - Camera Instl. (Less Camera)	+	40.40	-0.3	5.1
LES - Ordnance Instl. (Canard & Motor)	+	2.90	0.0	0.0
LES - Tower Leg Door Covers	+	0.50	0.0	0.0
Total Correction LES/GM	+	713.00	-0.82	-1.37

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WEIGHT BREAKDOWN SUMMARY  
LAUNCH ESCAPE SYSTEM  
BOILERPLATE NO. 23

	WEIGHT (POUNDS)
BASIC STRUCTURE	(1568)
Tower Assy.	350
Escape Motor Skirt	209
Canard	872
Insulation	119
Attaching Parts	18
EXPLOSIVE BOLTS (Partial)	(5)
PROPELLSION	(5363)
Escape Motor (Live)	4786
Pitch Control Motor (Live)	49
Jettison Motor & Interstage (Live)	528
ELECTRICAL	(92)
INSTRUMENTATION	(106)
BALLAST INSTALLATION	(443)
Ballast Plates	414
Ballast Stud & Nuts	26
Ballast Retaining Plate	3
BOOST COVER	(578)
MANUFACTURING VARIATION	(-10)
LAUNCH ESCAPE SYSTEM WEIGHT	8145

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~~CONFIDENTIAL~~ SID 63-143-12W

**WRENCHENUM**WEIGHT BREAKDOWN SUMMARYCOMMAND MODULEBOILERPLATE NO. 23

	WEIGHT (POUNDS)
BASIC STRUCTURE	(5242)
Structure - Less Ablator	4930
Ablator	312
SECONDARY STRUCTURE	(3045)
Internal Ballast	1984
Forward Cover Ballast	90
Aft Heat Shield Ballast	699
Equipment Racks and Supports	190
Coldplates	61
Tension Ties (Partial)	21
STABILIZATION AND CONTROL	(34)
ENVIRONMENTAL CONTROL	(105)
EARTH LANDING SYSTEM	(692)
INSTRUMENTATION	(326)
ELECTRICAL POWER SYSTEM	(351)
COMMUNICATIONS	(215)
MANUFACTURING VARIATION	(-35)
COMMAND MODULE WEIGHT	9975

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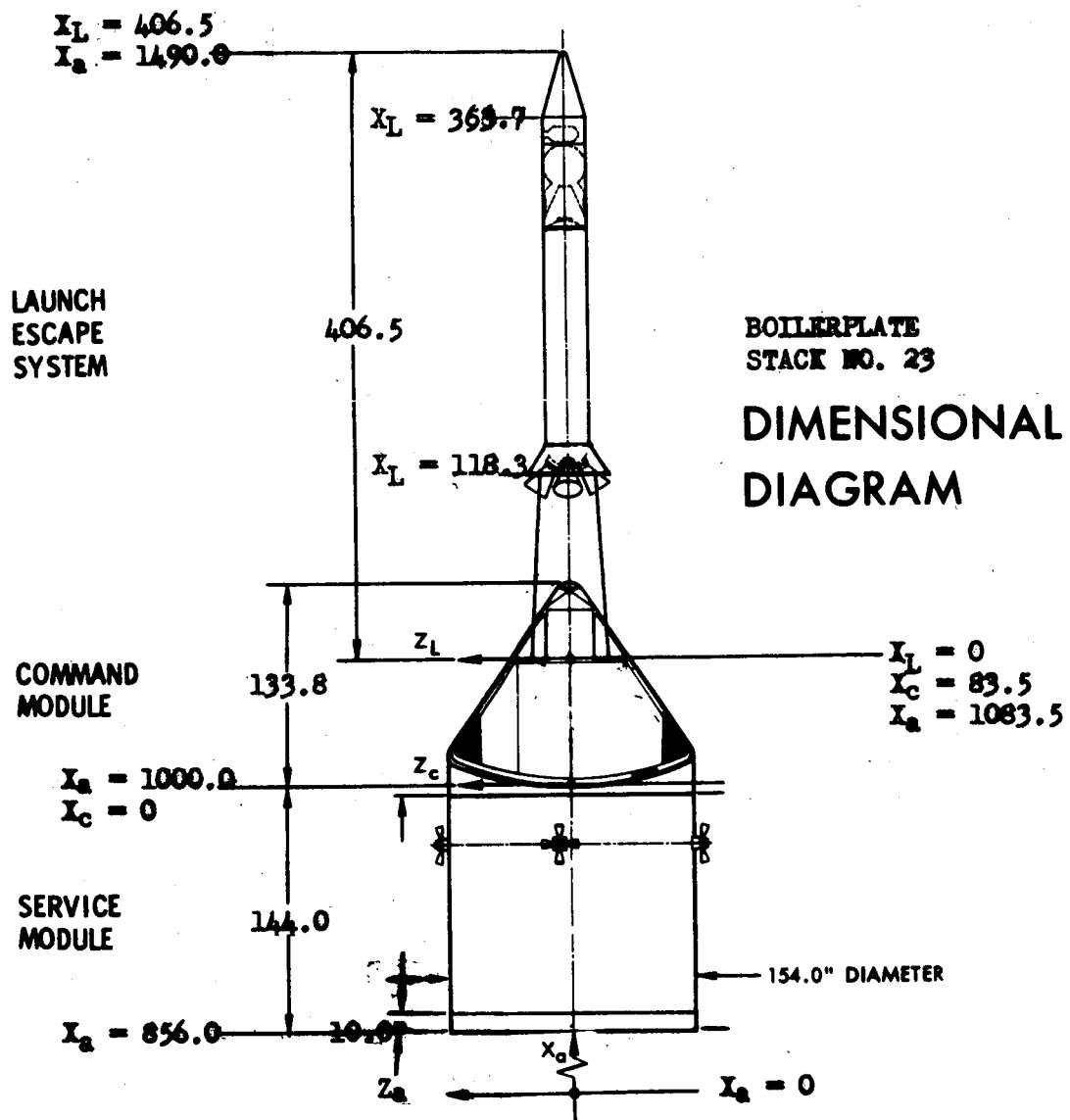
SID 63-143-12W

**WRENCHENUM**

**CONFIDENTIAL**WEIGHT BREAKDOWN SUMMARYSERVICE MODULE  
BOILERPLATE NO. 23

	WEIGHT (POUNDS)
BASIC STRUCTURE	(8266)
SECONDARY STRUCTURE	(913)
Internal Ballast Tension Ties (Partial)	902 11
INSTRUMENTATION	(185)
ELECTRICAL POWER SYSTEM	(61)
MANUFACTURING VARIATION	(98)
<hr/>	
SERVICE MODULE WEIGHT	<b>9523</b>

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